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JOURNAL OF SCIENCE.

JULY, 1884.

I. THE DOMESTIC ANIMALS IN THE "PILE-DWELLINGS" OF THE BIEBR LAKE.

MUCH attention has been drawn of late years to the pre-historic remains discovered on the margins of certain lakes in Switzerland. Most of our readers will be perfectly aware that the shores of the lakes of Geneva and Neuchatel were once inhabited by a race of men who in many respects resembled the Dyaks of the Eastern Archipelago. As a means of security against enemies these extinct Swiss tribes drove piles into the lake bottoms in shallow parts, and on the summits of these constructed their huts. Like the Dyaks, further, they adhered to the same style of architecture, even in spots not overflown—constantly at least—with water. Whether this singular custom may be regarded as a "survival," proving man's ultimate descent from some tree-haunting animal, is a question which we cannot here discuss.

That the remains of these old dwellings have proved invaluable documents to the ethnologist need scarcely be insisted upon. But the zoologist—taking the word in its ordinary limited sense, as applied to one who studies the lower animals only as distinguished from man—is not less concerned. During the last ten years important drainage operations have been carried on at the Biebr Lake, which have permanently lowered its level and laid dry a considerable tract of country. Here, of course, a more extended and systematic exploration has been rendered possible than could be attempted on the shores and in the shallows of the

lakes of Geneva and Neuchatel. Besides artificial objects of various kinds, the bones of animals were collected and removed to the Museum of Berne. Here they have been carefully studied and arranged by M. Th. Studer. The results of his investigations, of which we give a brief abstract, may be found in detail in the "Transactions of the Berne Society of Naturalists" (1883, Part II., No. 1042).

From an examination of the artificial objects it appears that the different stations along the shores of the lake represent very different stages of civilisation. Arranged in the order of time we have Schaffis, Lattrigen, Lüscherz, Vinelz, and Möringen. M. de Fellenberg, who conducted the explorations on the Biebr Lake, gives the following sketch of the characteristics of these different stations:—

At Schaffis the production of implements of polished stone is only in its dawn, whilst fine tools of flint show the culminating point of the preceding epoch, the Palæolithic. In accordance with the character of the stone-articles, and of the objects of horn and bone, is that of the pottery, which is not to be distinguished from that of the Cave-dwellers, and represents the first attempt in fictile art.

Lattrigen and Lüscherz show a higher stage of culture. Here there is a profusion of objects of stone, horn, and bone, and a finish in their workmanship such as is met with in no other station in Switzerland. In certain branches of these manufactures we find marks of a kind of prosperity, and even luxury, which fix the date of this station as belonging to the later Palæolithic epoch.

Another station at Lüscherz, situate deeper in the lake, and that at Vinelz indicate further progress. Along with the stone and bone implements of the earlier epochs we find here stone hatchets, perforated to receive a handle, and thus giving the advantages of greater weight and of a double edge; or one side is to be used as an axe, and the other as a hammer. The most important step, however, is the use of metals, and in the first place of copper, which is applied to tools modelled exactly after those of stone.

Finally, at Möringer we find ourselves landed in the full development of the Bronze epoch. Tools of stone and bone are here completely superseded by manifold articles of bronze. The clumsy stone axe has given place to the bronze hatchet and the bronze sword. Prosperity is evinced by the numerous articles of personal decoration, armlets and anklets, &c. The frequent occurrence of grindstones, grain-crushers, grains of corn and bread, are signs of agricultural industry.

During this lapse of time, extending certainly over thousands of years, the animal world, and especially the domestic species, had passed through changes which M. Studer has investigated by means of the abundant material of the Berne Museum. His attention has been especially directed to the dog, swine, sheep, goat, ox, and horse, whilst the coeval wild animals are merely noticed in passing in the introduction to his memoir. The results are equally interesting from a zoological and from a historical point of view, and may thus be summarised :—

In Schaffis, the station representing the most primitive type of culture, we find, along with domestic animals, beasts of the chase in about equal numbers. Amongst these, furry species play a part much more prominent than in the pile-villages of more recent date. Among the tame animals there is little variety. The dog, the swine, the goat, the sheep, and the ox are represented each by a single homogeneous race. Not one of them has an endemic wild representative, from which we might conclude that it had been tamed on the spot. The dog is the small "peat-dog," very different from the wolf. The swine differs clearly from the wild boar, and the ox from the urus. Wild representatives of the forms *Capra* and *Ovis* were then as little known in the Swiss plain as at present.

As regards other pile-villages in Switzerland the same facts appear to hold good. According to Rütimeyer the small "peat-cow" was met with almost exclusively in the oldest settlements, Wangen and Moossedorf. The "peat-swine" of Moossedorf seems to have been little modified by domestication. The sheep is only represented by the small peculiar race. As wild representatives of these species were absent in Swizerland even in the epoch of the pile-villages, they must have been brought from their aboriginal home by the first men who settled on the Swiss lakes. Where is this primitive home to be sought ? An indication is given by the use of stones foreign to Switzerland, such as jade or nephrite from Asia, for the manufacture of axes. The probable origin of the dog is the northern declivity of the great Asiatic mountain mass. The decisive researches of MM. Nathusius and Rütimeyer have placed the Asiatic origin of the "peat-swine" beyond doubt.

Rütimeyer considers that the *Brachyceros* ox has the closest affinity to the Indian forms of the genus *Bos*. The origin of the goat-horned race of sheep has yet to be sought, but it certainly deviates plainly in the formation of the horns from those which may be traced back to the

mouflon of Southern Europe. Even as regards the goat its descent from *Capra ægagrus* cannot be assumed as demonstrated.

The Asiatic origin of the primitive domestic animals of the pile-builders is further testified by the circumstance that both the swine and the dog can be traced, with little modification, as far as the islands of the South Pacific. This does not compel us to believe in a South Asiatic origin of these animals.

The discovery of the "peat-swine" in the old Tschudi-graves of the Ural, and that of the "peat-dog" in the Palæolithic deposits on Lake Ladoga, as well as among the peoples of North Siberia and the Red Men of North-western America, prove rather that these animals were first domesticated to the north of the great highlands of Asia, and that they afterwards spread in company with man, along the northern slopes, on the one hand westwards, and on the other to the east. The way to the Papuan Archipelago might lie, therefore, not directly through India, but through Eastern Siberia and China, and thence southwards through Further India and the islands of the Malay Archipelago. From this point of view a study of the races of domestic animals of Eastern Asia would be of great importance.

In the late Neolithic epoch, as represented by Lattrigen and Lüscherz, we find that the inhabitants, along with the chase of the large ruminants of the forest, were mainly engaged in the breeding of cattle. The wild ox was tamed and crossed with the previously tame race. The transforming agency of breeding extended to other domestic animals. The dog was modified in three directions: there arose a race approximating to the Pomeranian dog, a collie, and a hound. Sheep and goats were developed into larger and more powerful forms. The remains of domestic animals occur here in great abundance. The station Lattrigen alone yielded several cwts. of ox-bones. Hence we draw the twofold inference that this village was inhabited for a long time, and that the people were rich in herds of cattle. Attempts seem to have been made here to introduce new races of animals. The scanty remnants of large races of goats and sheep, which probably drew their origin from the Mediterranean region, show that extended intercourse took place, and that the lake-dwellers had formed relations—direct or indirect—with the people of South-western Europe.

At this epoch, when copper first came into use, and when the implements of stone took a more practical shape, we

find a certain decline in cattle-keeping. In the ox we perceive the beginning of a racial degeneration, whilst the sheep and goat reach their highest development in size and strength.

At Möringen, which represents the Bronze epoch in its fullest bloom, we find a picture totally different from those of earlier days. The remains of beasts of the chase are rare in comparison with those of domestic animals. The bones of the latter are much more broken up, as if with an increasing number of consumers a more minute subdivision of food had become necessary. The domestic races are almost all different from those of the Stone Ages. The sheep has come to the front in place of the former predominance of the ox. The race of sheep is distinctly new, whilst the cows are small and bear marks of degeneration. The pristine dogs have been superseded by the large wolf-hound, and the "peat-swine" is succeeded by the long-eared house-swine. A new domestic animal, the horse, makes its appearance, destined in future to play the most important part in the life of the European nations. It makes a turning-point in the existence of the pile-builders. The water, hitherto the only possible route for intercourse, is to a great extent replaced by the land-road, practically shortened by this swift-footed beast. Cattle-breeding gives place to agriculture, and sheep are therefore kept as better fitted for browsing the stubble fields than oxen.

The same changes occur in other pile-villages. Morges, a rich station on the Lake of Geneva, belonging to the Bronze Age, is the exact counterpart of Möringen. The horse is there met with of the same small, fine-limbed race, and the sheep is represented by the hornless race of Möringen. The same is the case, according to Rütimeyer, at the Bronze stations of Chevroux and Cortaillod, on the Lake of Neufchatel.

The above-mentioned changes in the domestic animals of the lake-dwellers of the Bronze Age can be explained only in part by the transformation of a nation of herdsmen into tillers of the soil. Such a change would scarcely explain the total disappearance of the earlier race and the sudden occurrence of new ones. We might therefore be tempted to accept the view of Troyan and Mortillet, who connect the bloom of the Bronze epoch on the Swiss lakes with the immigration of a new race of men, bringing with them new domestic animals.

II. WHAT IS RELIGION? HYLO-IDEALISM?

By S. BILLING.

(Concluded from page 326.)

TO resume remarks on the pamphlet immediately in question, "What is Religion?" We have the query, but not the answer. It is much more easy to understand that the world of phenomena originated from intelligent design than that matter so ordinated itself as to produce all phenomenal appearances, including life, consciousness, sensation, and intelligence. We are to condense all phenomena into "thinks": such phrase can only be understandable on the hypothesis that all phenomena are due to intelligent direction, and that phenomena are really thoughts made objective, *i.e.*, the great positive intelligence of the Universe—God, presented his thought in an objective form; in other words, that the thought of the Creator was made objective in substance, and thus the continuous presence or thought of God, presented as phenomena, informs by conscious impression the intelligence of man, and thus man perceives phenomena and conceives (ratiocinates on) the intelligence which formed them: thus, for so much of the absurdity there is found a rational extrication, but then the unaided *monism* must be abandoned. There can be no question but that phenomena have an absolute existence without the thinks or consciousness of man; for it is presumed these exceptionists do not deny the results of physical science. Geology and astronomy teach us that the Universe is an existence, and that our Earth was also an existence even before it could be cognised by an earthly intelligence, for it cannot be assumed that the lowest forms of animation had an intelligence such as could comprehend the relations of thing to thing; hence the world existed, so far as finite *thinks* are concerned, even before these thinks had an existence. If we are to adopt these thinks, the system should explain what and whence are life, consciousness, sensation, and intelligence (the actors and interpreters of things as they be), and should show at the least how they could emerge from *brute* matter (Hume) and dominate it. If the brain *per se* thinks, why was not its action disturbed when Sir Charles Bell stirred the white substance of the brain of a living subject? That the brain is the organ of the mind,

in manner as a conductor, cannot be disputed; but that it is the originator of intelligence, being itself matter, is but an assumption, because a thing can be no more than the product of its particles. We do not say the letters in a book are the intelligence,—they are only the forms of its conduction; so the watercourse is only the conductor of the river. These facts are admitted, because we are cognisant of their whole action. To say that sensation, intelligence, vitality, and consciousness are brain creations arises from the inability of physiologists to find the animating principle. All that interferes with perfect conduction in electrical experiments interferes with the result, and so it is with brain action: cut the nerve of sensation (motor), and the power of movement ceases; vitiate the substance of the brain by disease, we have then an imperfect receiver, and intellectual definition is destroyed. All effects result from causes: galvanise a substance, a frog's leg, and action is apparent, showing that an extraneous something is necessary for movement; and so no doubt it is with conscious intelligence,—an impetus, not of the substance by which it is manifested, is needed to excite its action, and the more free and perfect the apparatus through which it is manifested the greater power there is for its display. If intelligence were but a material consequent, it could not become greater than its source; there would be no such things as religious sentiments, moral aspirations, and abstract conceptions, but if all these principles are indued into matter it then becomes the manifestation of the intelligence of the Creator, enlarging in power as the receptacle becomes equal to its display. "To understand the Cosmos we can only conceive an embodied intelligence as its commencement, its object, and its end," and the "living and visible garment of God" but as the expression of his thought.

In old world thought Theology was all in all, but the methods have changed with the genius of the thinker; but now, "whether he has proceeded from the idea to infinite reality" (Descartes), or "from the contingency of the Universe to its necessary source" (Wolff), or "from the skill and beauty of Nature to its intellectual inventor" (Paley), or "from the moral law to its righteous legislator" (Kant), or "from records of past revelations to the character of the revealer" (Chalmers), (*Dr. Martineau's Ideal Substitutes for God*), we have the true cognition of a God, whether it arises in an idea, or in its formative originator, or in its cosmic realities as presented in design, or moral instigations, or revelations; all tend to the same end.

The treatment of this momentous subject in a purely "historical spirit" leads us directly to the origin and source of man's belief in a power beyond the transitory phenomena which surround him, leading him, by the aspirations of his own religious consciousness, to the yearning and desire for a something beyond and above his sense of finiteness, on which he can rely and trust in firm assurance that the bond can never be broken which connects him with his origin. Earth to Earth, Spirit to God. As "Geology is the methodical knowledge of the Earth's crust, Physiology of living organisms, Psychology of the self-conscious mind, Ethnology of the races of mankind," so "the science of Religion" teaches the rational apprehension of a creating God.

In Theologies we have overladen subtleties which overreach themselves, and are perversions of truth. Every system of Theology presents the miraculous, and the evidences of thaumaturgy are analogous. The great difficulty is that the marvellous always developes into the incredible. The commencement of all creeds is simplicity; the type becomes lowered, and eventually it as a Theology enters into the arena of verbal conflicts.

In the religious sentiment, implanted in the minds of all however it may be stifled or silenced, we have a direct and positive pleader, which, ignoring all superstitions, leads us into the immediate presence of the living Entity, unfathomable to the finite conception, but a living evidence and conscious witness in primitive thought which daringly launches "out on to the ocean of real being." We have "an intellectual and moral region in our natures," "two co-ordinate sources," the former bringing us to a transcendent cause, the latter to a transcendent righteousness; together finding their unity in an Eternal will, and thus "the final object of Reason and the final home of the Conscience are the same."

The monistic theorisers lay great stress on Nature as the all of phenomenal results, ignoring its grand synthesis manifested as a product of intelligence, relegating to matter its office and power. Nature with the Monist is but a manifestation of matter. Are we to suppose that in an universal conflagration (fire mist) chemical agencies were induced, which sifted, separated, and amalgamated the different stuffs recognised as matter, and the other agencies we know as forces: look at it as we may we find but impotence, and, like Lucretius, must seek for a lever to stir the inert mass into living substances.

What is Nature? Is it to be limited to the ordination of

the material phenomena with all its vital energies, or is it to be extended to the Universe with all its cosmic realities,—with its galaxies of suns, and probably their attendant worlds,—all so accordant in action that the combination is unity? If this be so, plus intelligence, ratiocination, and wisdom, then Nature is that which the religious mind recognises as God—the ordinator, creator, and maintainer of matter, its formator, and law-giver. Contemplate the subject as we may we are compelled to admit an originator, or accept the most astounding of miracles, chance, with its billions of millions of accidents, resulting in homogeneity. Does it follow that Monistic nature has uniform action throughout the stellar universe? Although the same materials, as manifested by spectrum analysis, appear to be the components of all: even granting that the inorganic substances are the same, still their chemical amalgamations may be wholly different, as we see even in earth mixtures,—*e.g.*, isomeric compounds,—the same substances in different amalgamations producing opposite results, delicious odour or rank disgusting substance, refreshing beverage or deadly poison. It is more than probable that other orbs than Earth are inhabited, and present a flora and fauna, and probably present different constitutions to those we know: there may be also climatic differences which would increase the diversity, for position and magnitude must be taken into account. If this be so, it follows that Nature is discriminating, *i.e.*, intelligent, and adapts her powers to the uses to be applied. Is it to be said that all this can result from chance? If, then, chance be excluded from the problem, in what then does Nature differ from that grand reality of power, omniscience, and omnipresence we term God? In Nature we have direction, creation, and maintenance; the adaptation of mechanics and chemistry to direct differing conditions of substances, all intelligibly marshalled. There is no law of chance which by any possibility can arrive at the same conclusions: add direction to chance, and the chaotic idea, chance, must be abandoned.

In Natural Science the true man of Science appreciates the display of natural harmony—the unity, the multifold variety, and the delicate balance of "physical and vital activities." The greater his knowledge the more fully his mind embraces the complex inter-relations of the animal and vegetable world. The hills, the plains, and the waters tell the history of the world when there was no sentient inhabitant to record it. In their harmonious relations it may well be said that there is not only beauty, but

goodness, conducing to an end to be achieved in far on and outreaching æons of time. In the bowels of the earth, in geological eras long past, were stored those deposits which have been and are the great engines of civilisation,—stored in times of seeming desolation, blazing volcanoes, devastating storms, and their sweeping floods. Was the order which resulted from these seemingly devastating ruins accident? Were the ores buried in the earth accidents anticipating the advent of man and his necessities? Shall we not rather say that herein is the evidence of a design so far reaching as to order the why and the when, guiding and maintaining all in the forms of rigid law, unerring in results, provident in its exigency, anticipating the necessities of denizens of Earth not then in being? A better name can be found for this providence than Monism and its shallow deductions affords. Where is the mind which can measure the grand scheme of the Universe? Where the mind which shall define the limits of this providence? The further we probe Nature's characteristics, the further we can fathom the science and methods of Nature, the further we recede from accidents as a cause, and find in our researches the acts of a great and inscrutable will, which fashioned events and anticipated all the necessities which must evolve when the principle of intelligent life was established on Earth. Nature is the great mother; she dips into matter, and completes its subjugation by compelling it so to act as to satisfy her demands: this is shown in the aptness of phenomenal display, where every want is supplied, every gap profusely filled, yet without wasteful expenditure; there is nutriment for the creature and seed for the reproduction of the vegetable protoplasm, the support of animal life. Thus we find systems within systems, each to each linked by a bond of order wherein there is neither laxity nor loss: all are absorbed in the endless routine of existence, each playing its allotted part, all leading up to and ending in its complement —MAN.

C. N. appears to confound Religion with systems of Theologies or creeds. In all he suggests there is no presentment of humanitarian realities which tend to elevate the race; but this is impossible with a philosophy which commences in self and consolidates all in self, even creation —*i.e.*, in the Ego.

We find a long dissertation on the wantings apparent in theologies; Catholicity appears to be the *bête noir*. Gibbon has done this work better than C. N. can ever hope to do: a citation of the celebrated XVI. and XVII. chapters, in

the second volume of his history, had there been a necessity to touch the subject in any way, would have been all-sufficient. The wantings of Theologies, even with a citation of all their horrors, can add no glory to Hylo-Idealism. Then follows a dissertation upon Mr. Bradlaugh; what has it to do with the question, except perhaps to show the animus of the writer? Mr. Bradlaugh asserted his opinion, and accepted his position. He had accorded to him perfect freedom of discussion. Of what has he to complain? that general opinion is adverse to the propositions he promulgates. The wonder is that he, so able a man, has arrived at so illogical a conclusion (*vide* Maurice Davies's "Heterodox London," p. 116 *et infra*). So also we are told that the principles of Catholicism can claim no superiority over those "which inspired the French Revolution," whatever its result. The sense of wrong aroused the people, and they triumphed; law and order were perverted, the conception of a God banished, and greed, rapine, and murder reigned supreme. This is the result of the *Ego* and Hylo-Idealistic thinks; a despotism linked with irreligion blotted out all good, and ended in the establishment of a military despotism which was restrained by no act deemed needful for the consolidation of its power, and was subversive of the rights and freedom of all who came in contact with it. What has this to do with Religion? which, in its true sense, exemplifies the humanitarian principle "Do as you would be done by." Then follows an exposition of Pantheism; the grand idealisations of the Greek mind are sneered at; "sun and rain are translated by imagination into smiles and tears. The author would have been wise, before he gave vent to his imaginings, to have consulted Max Müller, Cox, and the first two vols. of Grote's "History of Greece": he then would have had some conception of the hold religious aspirations—Pantheistic if he pleases—had on the commonalty of the nations of Greece. Their idealisations, making gods and demons care-takers, were emblematic, and became the conscious cognition of the providence of the Supreme God. It would also have been wise to have consulted the works of Max Müller and Monier Williams before giving a pronounced opinion of the Vedas and other sacred works on the primitive worshippers of India. It is easy to conceive that a man who concentrates *his religious* (?) ideas in the Ego could never rise to the sublime conceptions of primitive worshippers. Every enquiry rightly directed as to religious belief finds the germ and intent of the founder, be the creed what it may, moral, pure, or humanitarian. It does

not follow that when it is perverted into a Theology that therefore its origin was impure. We are then indulged with observations on Pantheism; and what is Pantheism but the worship of the spirit which was supposed to underlie Nature? It was not the worship of matter, or man, or the self! Thackeray says when we have well studied the world "how supremely great the meanest thing in this world is, and how infinitely mean the greatest;" and he is mistaken if there is not made "a strange and proper jumble of the sublime and the ridiculous, the lofty and the low," and in the end "know not which is which." How forcibly this applies to the absurdities of this Hylo-Idealism theorem is illustrated in a note (p. 19), by its wonderful logical discoverer, who centred all creation in his own finite self. He tells us, "All this mysticism, this ascription to an objective deity of our own subjective feelings, seems quite elucidated by the principles of Hylo-Idealism. Mind in Nature there is, but it is our own mind, alike the concipient and precipient of Nature." Thus, to get rid of any reverential or moral attribute, we are to adopt a mysticism only worse confounded, and are to end in not knowing which is which.

Modern science, as any logical or sensible man would construe it, is very far from teaching that "man is the measure of all things." It shows the insignificance of the human mind in comparison with the energies of Nature. Man discovers effects resulting from causes, and mechanically imitates Nature to produce results which may be beneficial, primarily to the satisfaction of individual greed rather than, to the promotion of human happiness: to this latter result absurd philosophising and socialistic reasonings stand in the way of its consummation. In vain we are to look for an amelioration of our social status if "man is the measure of all things," or "of the universe for man." The animal man is self, and self only; and well may the Hylo-Idealists deny the purer and better aspirations of man. Self is greed, and we have its aspirations in every social position, and unhappily it grapples too successfully with the aspiration for freedom from the animal nature of man to which Materialism would chain it. If soul, intelligence, consciousness, vital energy, and sensation are the emanations of matter, man cannot rise higher than his origin, and, were it so, would for ever remain but a conscious beast; for what creature is so cruel as the animal man? All which makes life really good, beautiful, and desirable, the humanitarian principle which alone can elevate man, is intellectual truth, eliciting moral realities ending in abstractions which practically

illustrated make it possible for man to live with his fellow.

C. N. and his followers should consult German scholasticism if they wished for a classical disquisition on the theory of the Sophist. It were a better inspiration than Dr. Büchner and their own Messiah. When he says that Erigena, Averroes, and Bruno found in Pantheism "their spiritual home," he shows he has never read their works,—if he has, then he has not understood the theses they propounded.* With such authors, and too frequently with their readers, a parade of grand names is all-sufficient; it is no matter whether wrongly quoted or ignorantly introduced, they go to make up the claptrap; but perhaps C. N. may stand excused when a man known to fame endeavoured to make Bruno and Gassendi—one of the finest intellects of his time—the stalking-horses for his own Materialism. Carlyle and Goethe were not spared, and the great science of Maxwell introduced with a sneer; and the *ethic glow* was a mechanical monstrosity which existed only in his own conception.

It is quite true "*If* our simple sensuous perceptions are the result of cerebral organisation, it is evident the same must be affirmed of the ideas produced from their syntheses." Well may we have an "if": it is evident C. N. was not convinced, despite the positive affirmation of the notes. He then kindly tells us—"Though incapable of universal scepticism, and forced to assume the real existence of some protoplasmic substance generating all those images of which our consciousness is composed, we shall not clothe this protoplasm with Divine attributes, and bow in worship of the absolute and unknowable." He says that the Agnostics are but half-hearted; but this may be said, that whatever may be their conclusions the leaders of the movement are generally men of high science, and do not glean digests in order to establish their problem. The Agnostic holds that the existence of anything beyond and behind material phenomena is unknown and (so far as can be judged) unknowable, and especially that a first cause and an unseen world are subjects of which we know nothing; thus contravening the scientific parallel that the unknown shall be interpreted by the known. The phrase Agnostic is said to

* If C. N. desires to know what was the teaching of Erigena (with his ideas Bruno greatly concurred), he will find a Synopsis of Erigena's work "De Divisione Naturæ" in the fourth volume of Sharon Turner's "Middle Ages" (p. 417 *et infra*); he will find something more than Pantheism there. Erigena's work on the Vision of God has eluded modern research. Nor in the account of Averroes and Bruno will he find any status for his assertion (*vide* Draper's "Conflict of Science and Religion").

have been suggested by Prof. Huxley, who is twitted with the endeavour to make men know how little they know. The Bishop of Manchester says "The Agnostic neither denied nor affirmed God; he simply puts him on one side." It is a higher grade of mind to refuse to discuss that deemed unfathomable because it cannot be reached by the scientific method, than to deny *in toto* the existence of a creating God and substitute in his place the thinks of individuals whose only possibilities of information are sense impressions. The presentment of a tree, a flower, or a creature to one of these great thinkers should shame such a proposition into an utter confusion. Thinks, what thinks!! the impression of the surfaces of images on the senses. Well it may be held that the animal instinctives and man's mind are the same in calibre and substance, for so far do some of our *savants* carry their theses, presenting, as some do, the very commonest and necessary and unmistakable animal habit as the proof of a discriminating mind! Both animals and men have their tribal distinctives, differing in both with the species, but man has, in addition to animal instinctives, "the power of forming abstract ideas, such as humanity, truth, &c.; a power of apprehending not only existing objects, but also the fact of their existence; a power of reflecting on their own being and consciousness; a power (by voluntary attention) of recalling, or seeking to recall to mind our past thoughts; a power of uniting two simple intellectual apprehensions into an explicit affirmation or negation,—that is, power of judgment; a power of induction; a power of true inference, of intellectual emotions; a power of expressing intellectual feelings and ideas by definite external signs, intellectual language, and a true power of will."

We are also told that if we were consistent we should renew the old doctrine not only of an animal, but also of a vegetal soul. This subject was discussed at the meeting of the German Association at Munich (1877), and was asserted by Nägeli and Haeckel, and repudiated by Virchow. Nägeli no doubt founded his argument on the Aristotelian idea, which was utterly distinct from the theological meaning of the word soul. The Ancients considered the soul as the unifying power which makes vital activities a synthesis, or the bond which makes the varied activities and weaknesses an united power. As an illustration may be cited the old man and the bundle of sticks, the cord which binds them making their synthesis,—a faggot,—weak individually, strong as a whole; and thus the *animus mundi* was a grand idea—multiety in unity.

We are also told—"If, then, in our definition of matter we substitute energy for extension, we shall no longer be able to distinguish between matter and spirit, and shall be forced to find in Hylo-Idealism the reconciliation of poetry, philosophy, and science." Is this, then, the all which makes the sum of life, and for which thinking men should aspire? Is there no room in this theory for duty, moral aptitudes, and religious sentiments? "No reasoning can be true which ends in an absurdity."

The great object and end of life should be the fulfilment of duty, however multifarious may be its action; in duty are all humanitarian sensibilities, all morals, and religion. "The more thoroughly a man is impressed by the idea of duty, the more his whole being is saturated with the idea, the more goodness will show itself in all his, even spontaneous, actions, which will have additional merit from their very spontaneity." It is the selfdom and self-interest combined; the first teaches the satisfaction of the needs due to the self; the latter that grand humanitarian principle which is the bond of all social accord, and sets forth the true relations which each man has to his fellow, and ends in the revelation of the grander principle which at the same moment knits man with man, and man in his strife for perfection with the supreme ordinating principle: then man is uplifted from the dominion of self, and in the concentration of his energies, to the contemplation of the origin of all things: this is Religion,—disclosing the link which binds the human in the divine, enlightening his search for purity and truth, wherein is alone to be found that bond link which makes the Universe akin, and the human and the divine an inseparable unity, harmonious, effective, real.

Little does C. N. appear to know of the religious feelings of such men as Wesley, Wilberforce, and thousands of other eminent Christians, and we may be well content that he does not give a disquisition on Religion. He sets out by asking, What is Religion? but most carefully eschews any relation of the realities and duties it enjoins on those who truthfully believe in the faiths they profess. He says, "Even by orthodox Christians the value of Religion is made to consist in its supposed ethical necessity rather than in any intrinsic and transcendental worth. It is justified as an indispensable means of human welfare, not glorified as the supreme end of human endeavour, with the implied inference that should it cease to be useful it will at the same time cease to be desirable." In other words, mere Utilitarianism. The records of history convey a different decision. There

then can be no wonder, when such views as above are enumerated, that the author does not tell us what is Religion, unless he supposes the solution of his query is Hylo-Idealism. He is careful to tell us he is not an Atheist; but in what Hylo-Idealism differs from Atheism I am at a loss to conceive: his ally, Constance Arden, affirms it to be pure Monism. He says, "Nor does it seem more glorious to be a little lower than the angels than to be the creator and fashioner of an ideal host of heaven, though their bright array be the offspring of a material organ."

"Having traced our intellectual and moral faculties to their seat in the brain, we shall cease to enquire for the noumenon of this ultimate phenomenon, and shall find ample scope for ideal aspirations in the sublime generalisation, that the sun, the moon, the stars, the hills, and the plains are but products of our finitely infinite personality. Man, if pure of heart and lofty of mind, must be crowned with glory and honour, whatever be the first cause of his sovereignty; a material origin cannot degrade his thoughts, if lofty." Can bathos go beyond this? The sun and all the astronomical phalanx, the angels and the hosts of heaven, all the creations of Man!! The Messiah steps in with a note, to cap this grand sublimity. "This apparent *catachresis*"—a grand word—"will be seen to be rigidly scientific when we recognise the sublime facts that life and death are only changes of condition, not of essence,—that the glories of our birth and state are shadows, and not substantial things."

It is quite possible that the theory of Evolution, as pourtrayed by Mr. Darwin, may show that there is no gulf between animal and man so far as his animal origin is concerned, and so it may show that there is a gradation from the lowest forms of life in mental (so to speak) processes; but it also shows that these gradations only ensue when the receptacle (not always a brain) is fitted for enlarged action; but it is quite another thing to say that the mental attribute (be what it may or however displayed) has its origination in the receptacle,—in other words, the vehicle through which it acts. We find conductors adapted to sustain greater strains, but not those of creation,—*i.e.*, the organ is exactly adapted to the use to which it is to be put. There are some more pages of surface science, and surface reasonings and absurdities, in support of this theory exploded more than two thousand years ago; in fact, condemned and refuted almost on its utterance. It is most difficult in this the nineteenth century to treat the matter with patience, or to

believe that men can soberly stand forth and advance this doctrine, denying as it does the pure Materialism on which it is founded, and the pure Idealism, another branch of its subjects, yet attempting to combine the two, producing a monster which is even in its very enunciation a shock to practical common sense. As to the metaphysical argument advanced, viz., that the Ego has no cognisance of the non-Ego, it being only an image. When a man, an Ego, sees another man, a non-Ego, do in similar circumstances exactly what the Ego does, it seems reasonable to conceive that the non-Ego is rather more than an image or a think, the more especially if the non-Ego, as a requital for an insult, should obliterate an organ of sense, say the eye. It is doubtful whether the Ego, on so practical a demonstration of reality, would continue to think that the non-Ego was only an image, or a think, or the result of its own cogitation,—or whether the excitation of sensation resulting from this practical analysis of the think would result in the belief that all the suffering inflicted was a mere synthesis of circumstances resulting from the think. The whole thing is too absurd to reason on. A ploughboy would confute the whole thesis by a rough and practical solution. In conclusion there are several pages couched in the peculiar style of these thinkers (?); but what can be expected when a man attempts to defend an absurdity which if accepted would displace all the guards with which humanity is fenced, but which is pretended to be an exposition of the grand good,—the reality of life, the object of man's place on earth. We meet such a phrase "since the" triumph of Christianity. What has the system to do with Christianity? Is it canting, or ignorance of the meaning which the word Christianity should convey?

Mark the summing up. How grand! What a boon to humanity, what a kindness to the non-Ego, that there should be a cognition of being! "In an age when some ideal of moral beauty inspires all the noblest and most beneficent natures, rigorous analysis is for the time undesirable. It would desecrate those elements of truth which are always interwoven with every vital and beautiful form of Error, and by a premature disenchantment and disintegration would destroy the old principle before the new one is ready to take its place. By dissecting away what was still throbbing with life, it would cripple where it was meant to heal, and would pull the skin from the snake instead of waiting until it became a slough. But in our days, when art, morality, thought, politics, and education are finally separated from

religion: when the living soul of ancient theosophies has departed; when the stern beauty of divine philosophy has well nigh ceased to attract even youthful votaries, our only hope of salvation lies in the conscientious endeavour to draw new life from Nature, and make Science itself a well-spring of ideal truth." With the result that it would all again be the old cry of the leech, give, give!

In this Hylo-Idealistic theory we have much metaphysical absurdity, Ego's and non-Ego's implying man only cognises himself, all else being mere images. If they be images only one may well be surprised at their tenacity; they have existed since time was, before man's advent on Earth, and probably will exist until the end of Time.

To grapple the problem in a philosophical spirit we should say that consciousness grasps the outer world, and reason and memory connect it with the interior, and thus the external and objective world becomes part of the self, or Ego, and it cognises the non-Ego as a part of the phenomenal world; and by the process of ratiocination the Ego, the non-Ego, and all other phenomenal presentments, find their unity in consciousness, and thus constitute for each the world of fact and being. All facts are the verifications of their repetition, vouched for by the senses: this is experimental evidence.

"The facts of memory imply that each of us has the power of knowing with certainty past real existences, and he who trusts his memory affirms this." The memory recalls its experiences, and through reason has relations with things which had existence before the thinker, and all others of his generation, had being, and will exist when he and they have ceased to be denizens of this Earth; *e.g.*, Cuvier at Montmatre found the skeleton of a small creature the skull of which had its lower jaw bent in: trusting to his memory of the past and his scientific experience, he predicated that when the stone was chiselled from the lower part of the pelvis there would be found a pair of marsupial bones,—and so it was: thus his memory and science made him akin to a fauna which had being æons and æons of time long past away, showing that in the world of facts we have to do with something more than evanescent images, *viz.*, substantial and real substances. Cuvier did not create the marsupial animal; he only discovered it. This Hylo-Idealism is a construction of the imagination and false logic. Even Lewes cannot help them when he tells us "that which is unpicturable may be conceivable, and the abstraction which is impossible to imagination is easy to

conception" ("Problems, Life and Mind," i., 420). A man "cannot imagine his own annihilation," but he "can conceive it."

The Cuvier illustration shows us that "our senses are recognised as telling us of an external world really existing in utter independence of us, and scientific views and theories are constructed and accepted in harmony with this recognition." Idealism cannot be true, because "it contradicts that conception of the Universe which the advance of Science makes more and more convincing and secure," and, moreover, "it asserts that we have not that direct knowledge of the world about us which our own minds assure us that we certainly have." Thus, "by building on the direct declarations of consciousness as a foundation, we may be certain that we really know an external world, and many qualities of independently existing things, and not merely our own feelings, or a mere amalgam made up from ourselves and from external bodies"; thus, "that an external world really exists independently of us," and that its "parts really possess those very powers and properties which our senses and our reason combine to assure us."

"Self-conscious, reflective thought is our ultimate and absolute criterion," for thereby alone "we know we have feelings." Without thought we might feel, but we could not know that we felt or know ourselves in feeling. "We believe in the certainty we obtain through the senses, though the certainty itself is not in them. Our ultimate appeal and supreme criterion is the intellect, and not sense, and that act of intellectual perception which is thus ultimate we may call intellectual intuition."

The standpoint of Hylo-Idealism is that "man is the measure of the Universe." Capt. McTaggart has made a correction, and adds for man, which correction is accepted. This does not change the monstrosity of the theorem presented as the highest possible aspiration of man, with its brain creations of mind, thinks, false images, metaphysical Egos, &c.,—the isolation of man in the self,—and that these thinks, creative powers, Materialism, is to be pursued to a certain point, so also Idealism, but neither to its logical conclusions. Haeckel's Monism differs from this Hylo, as does Berkeley's theory from its Idealism. Haeckel admits a cause, Berkeley a God: perhaps the protoplastic presentment is Haeckel's cause, and the thinks Berkeley's God!!

Herbert Spencer says, "If Ideation be true, Evolution is a dream; not Evolution only, but the whole of Physical

Science." Thus we find the great masters are opposed to this Hylo-Ideal theory in one or other of its forms. There being a harmonious relation in phenomena, there must be the same harmony in ideation, and ideas by the transformation of intelligence become reason and wisdom. The phenomenal, which is an effect, is transfused into its cause; the truth becomes known as part and parcel of ourselves; the beyond is then reached where intelligence is transfused into spirit, which, existing in its own truth, is freed from the trammels of the material phenomena, and exists with cognate existences in a world of intelligence where dwells the supreme cause of all boundless and eternal.

So far this weary work is accomplished, and we are presented with the Hylo-Idealistic theory as propounded by C. N. Captain McTaggart's work it is unnecessary to enter upon. Both assume the same basis, but this latter work is methodical and logical, so far as the subject will admit of reasoning. The subject is so fantastical that the wonder is it should find so able a defender. Take any basis as a starting-point, and metaphysical subtleties will found thereon an argument. Both works contain appendices: C. N. has six, the Captain five. That by Constance Arden is certainly an able review, or rather *resumé*, of Prof. Huxley's article ("Science Culture and other Essays.") So far as Automatism is concerned, with which she seems to agree, it is merely necessary to cite H. G. Lewes's summation:—"We can conceive an automaton dog that would bark at the presence of a beggar, but not an automaton dog that would bark one day at a beggar and the next day wag his tail, remembering the food the beggar had bestowed." Further, Lewes denies that Descartes favoured animal automacy. He says that Descartes was merely contrasting mechanical movements with animal motion ("Physical Bases of Mind").

As to the brain theory of mind paraded through the work, can it account for the following well-authenticated facts? A lady, the owner of a yacht, took a trip to Rome, taking with her as maid a Devonshire cottage girl. When at Rome the girl fell ill with fever, and was removed from the hotel to the yacht. Fear prevented the hiring of another attendant, and the lady attended the girl until she died: no napkin was at hand, and she covered the face of the corpse with her own handkerchief. On arriving in England (no possible communication having been had with the girl's connexions) the lady determined to carry the sad tidings

herself. On arriving at the cottage she found the mother seated at the door, and before the lady could speak said "I know what you have come for." She then detailed the circumstances of her daughter's death, and the covering the face with the lady's handkerchief. So also the incident mentioned by Col. Meadows Tayler in the story of my life —that of the Dead Soldier and its Incidents.

III. THE SAND MARTIN, AND ITS MIGRATIONS.

By Rev. SAMUEL BARBER.

ABOUT five miles south of Liverpool the suburb of Grassendale skirts the Mersey, where the river is about 2 miles wide. There is a sea-wall, or rather a wall-fronted esplanade, drained by passages underneath the parapet, and these open out upon the wall by apertures measuring about 10 inches by 6. Within these drains, and actually under the feet of the promenaders, a colony of sand martins have, for many years, found their summer home. At high water these birds may be seen skimming over the surface of the river, and beating along the coast, in search of insects, in a very methodical manner. Their chief hunting-field appears to be in front of the wall, which contains their eggs or young. No amount of wind—and there is plenty of it in this part of the world—seems to deter them from the chase. A casual observer might wonder where the insects came from to support such continual hawking, for the most ingenious devices would scarcely enable him to secure six flies in as many hours, if indeed he could find any at all that the breeze had not carried away.

Nature, however, abhors stereotyped methods in the regulation of animal economy, and exhibits in the varied conditions of bird-life, and in the adjustment of the appliances by which it is sustained, an elasticity and fertility of resource no less admirable than the variety of her forms. This is particularly true in the manner by which the supply of food for each species is furnished, and the balance of animal life maintained.

The sand martin, more than the swallow, observes regularity in the time of its appearance in this country. In fact

it seems to come *to the day*, or at any rate two or three days will fairly embrace their variation from the appointed time. Observations extending over many years induce us to expect them here on the 15th or 16th of April.* No doubt the condition of the weather has *some* effect upon this regularity of appearance, but very much less than it might reasonably be expected to have; and it will, I think, be found that the effect of weather upon the arrival of our British Hirundines has a relation rather to their *numbers* than to the mere fact of their appearance at a certain date. In the case of the other species—the house swallow, martin, &c.—there will generally be found a considerable instalment about the usual time given in the Natural-History Calendars; but if the season should be cold and stormy (as indeed it often is) the numbers of the first arrival will be reduced to a minimum. It may be remarked, however, that occasionally, in bad weather, the numbers seem to go on increasing for some time after the first arrivals are noted.

The migration of birds has been often and justly cited as affording the most striking and wonderful evidence of the operation of Divine Wisdom in allotting to the creatures, for a special end, an insight far transcending their ordinary intelligence. And in the modification of that instinct, and its subservience *to actual circumstance*, as in the case we are now considering, there is a striking manifestation of the power of Him who governeth all things in heaven and earth. A too close consideration of the *unity* of Nature, and of the *ordinary* working of the Almighty Artificer, may tend, with some minds, to darken through familiarity the truth that "Nature's law" presupposes a Law-giver: it is well, then, to consider also attentively the *exceptions* and *variations* from her ordinary course, inasmuch as the character and end of a law is often revealed to us by its interruptions.

It has been thought by some naturalists that swallows send forth scouts in advance of the main body, to examine, at the time of their migration, the climate of the country that they purpose visiting. And when we consider the distance of the countries to which they migrate, and the very great difference of climate existing between their summer and winter habitations, this appears not an unwarrantable supposition. It is, indeed, hard to imagine any other way of accounting for the delay of their main body when the weather is exceptionally severe in spring. And this is, to me, a much more reasonable way of accounting for the

* An article in the "Globe" lately placed the arrival of swallows about a week or ten days later. But my date, as given above, has been verified.—S.B.

fact of an occasional delay (which will scarcely be disputed) than by supposing them to possess, while in Greece or Asia Minor,* a kind of prophetic intuition or second sight as to the character of the *weather in England*. Or we may explain the matter in this way: the most vigorous birds will be likely to start first, and, if disappointed in the matter of weather and supply of food, would return to a warmer climate. It would not be extravagant to suppose that their return would then be a warning to the rest; indeed we have reason to conclude that these birds possess the power of interchanging ideas, or at least communicating impressions.

It may be thought an anomalous circumstance, by those who delight to study the *regularity* of natural laws, that many species of birds should so readily deviate from their peculiar habit, or instinct, in the construction of their nests. In the case of the sand martin the burrow by which the nest is approached is often 5 or 6 feet long, so that a vast amount of labour, in boring, is saved by their utilising an artificial cavity. And thus it happens that in the animal world, as well as among men, special intelligence overrules ordinary law, and the general good of the race is provided for, rather than the exact and unvarying execution of a *plan*, in all its details. From this point of view the dignity of animal life is enhanced, and we perceive in the whole scheme of Nature the expression of Infinite Benevolence, continually operative, and adapting circumstances to the wisest purposes.

IV. ON ELECTRICITY AND ITS PRESENT APPLICATIONS.†

By W. Fraser, A.M., M.R.C.S. Eng.

(Continued from page 337.)

AS none of the necessary elements of life are so indispensable as Electron, so there are none of them so universally diffused, accessible, and in fact inseparable from all living things. These can be very easily, and often with fatal results are, deprived of heat, light, air, or

* It seems ascertained that Hirundines migrate to this distance, at least.

† Read at the Aberdeen Philosophical Society, February 5th, 1884.

water, and food; but no prison or solid walls, no laws or ingenuity of man, can deprive them of the presence and ministrations of this all-pervading spirit. The toad or frog shut up for hundreds of years in a solid rock can be kept alive by this, the only *pabulum vitæ* which can have access to it.

The invaluable services of Electron, too, for specific purposes are also at the constant command and use of all mankind. The breast of mother Earth can be tapped, so to speak, anywhere and at any time, and the necessary supply of energy drawn from it, provided the individual has the requisite knowledge and skill to use the appropriate means for the purpose. These means, in the present state of our knowledge, are, it must be admitted, somewhat complicated and expensive, and sometimes not even devoid of danger; but in the progressive advancement of Science and experience there is no doubt the means will yet be discovered by which his services, whenever and wherever they are wanted, will ultimately be much more readily and simply brought within the reach of mankind.

When Electron is made closely to embrace and to pass repeatedly round a portion of his favourite metal, it becomes magnetic,—that is to say, so imbued with his spirit as to have the power of attracting to itself, and holding firmly, portions of the same metal equal or even greater in weight than itself. This fact or phenomenon forms the basis of what may be called the science of Electro-magnetism, and is the source of the motive (electromotive) power which is the great agent in many of the achievements of Electron. A variety, too, of the metal iron, called Loadstone, is to be found in some parts of the world which has the same quality, with the addition of being able, by close contact and repeated embraces, to communicate it permanently to other members of the ferric family. And in connection with these an important passage in the history of Electron has now to be mentioned.

These magnets, as they are called, have a tendency to arrange themselves, and when allowed perfect freedom of motion *do* arrange themselves, in a line parallel, or nearly parallel, to the axis of the Earth,—a wonderful property, which is taken advantage of (and has been for many centuries) in the form of the mariner's compass, for the safe guidance of ships across the pathless ocean. But less than one century ago a Danish *savant*, named Oersted, discovered another singular peculiarity of these magnetic imps, namely, that the instant they find themselves in the presence of

Electron they make a reverential sign of obeisance to him, which he (doubtless in some way to us invisible) acknowledges). If he approach them in front, they turn to him by a movement to the right; if he approach them from behind, they face round to him by the left; always retaining their position across, or at right angles to, his path, during the presence of their great chief.

Little did Oersted foresee the important uses afterwards to be made of the little odd peculiarity he had discovered; but succeeding wise men who have given themselves to the service of Electron, by taking advantage of this devoted attachment to their chief of these small magnets, have devised a way by which persons living at the greatest distance from each other may hold almost immediate correspondence. And this is the way in which this Godlike achievement can be accomplished:—A copper or iron wire is laid either above or below the ground, or along the bottom of the sea, of any length, from a few yards to thousands of miles, and the Genie being exorcised, *secundem artem*, from his place of concealment, can be sent by qualified attendants or operators, along this favourite pathway, to the place intended, where he is made to pass across one or more of the magnetic imps, who instantly give him the *quasi* military salute just described. These transmissions and salaams can be repeated so rapidly, and timed and grouped together in such a way, that a code of signals can be formed by them that shall be equivalent to ordinary language, and be easily transferred into it by those in charge at either end of the wire of communication; and so rapidly can he do his work that three or four clerks, at either end, can be sending and receiving messages, and nearly as quickly as they could be spoken. At the same time, by the same wire, Electron can even write out the intelligence he conveys as fast as it is sent, provided he is supplied with the necessary materials and suitable apparatus for the purpose.

But what is still more wonderful, and demonstrative of the power and wisdom of the Master whom he serves, this Genie can in an instant send his voice, in an audible and intelligible form, to a distance of hundreds, or even thousands, of miles. And this is the way in which this lately discovered power of his can be applied to the service of mankind:—An imp belonging to the ferric, or some of the other tribes for which Electron has a partiality, is selected,—of a thin, expanded, delicate, and highly sensitive structure, and is placed in a position where the Genie can have free access and contact with it. A person wishing to speak with another

at a distance (whether a few streets or a thousand miles away) has only to address his words near to this imp, whose sensitive body is immmediately made to vibrate in harmony with the sound-waves of the voice. These delicate and invisible vibrations are recognised and received by the Genie where he lies enveloping the atoms of the imp, and are by him carried to the other end of the line of transit, where they are repeated by him in the body of another imp similarly placed in regard to the conducting medium, with the result of causing corresponding vibrations in the air, so as to reproduce sounds and words exactly corresponding to those emitted by the speaker at the distant station, so that his listening friend can hear them instantly and exactly as they were pronounced,—so exactly indeed (as probably many of you have had an opportunity of verifying) that the person listening can say at once "This is Mr. So-and-so," or that is an Englishman, an Irishman, a Frenchman, or a lady, or a child.

Intelligence so transmitted, by either of these methods, can be quickly communicated by messenger to the person for whom it is intended, or to the public by means of the newspaper and the post; and so the spirit Electron may be said to supply the office of a nervous system to the world, keeping all its parts in immediate sympathy with each other, and enabling them to act in harmony for the general advantage. And thus, by the immediate and unimpeded interchange of intelligence, and the prompt removal of prejudices and misunderstandings throughout the world, Electron is becoming one of the chief harbingers of the "good time coming,"—that millennium which many of the nations are longing for and looking forward to.

The delicate perceptions and touch of women are found to be peculiarly adapted for these manipulations, and it must be gratifying to the advocates of women's rights to find that a new field has thus been opened up for their employment which is at once congenial, scientific, and remunerative. In one room alone at the London Post-Office, in St. Martin's-le-Grand, there are a thousand female clerks, whose active brains and fingers are constantly at work; and from this instance we may judge of the vast army of women employed in the service of Electron throughout the world!

The movements of a Spirit such as Electron are essentially of a different nature from those of material things which are acted upon by the laws of gravitation and other forces which are readily recognised by our senses, and which can be intelligibly comprehended, measured, and practically

formulated. Spirits like Electron, being almost destitute of weight, cannot, unless in a slight and indirect way, be influenced by gravitation. Their inconceivably rapid motion is entirely unlike that of gravitation, being more of the nature of mental emotion or of vibration than of a bodily change of place. The Electric Spirit, in so far as it enters into the constitution of material things, and functionally permeates and envelopes them, will accompany the world in all its movements; but in other respects it will not accompany it, and will only but slightly participate either in its rotation or its orbital motion.

It will thus be understood that the Earth, in its diurnal motion, brushes through and athwart the portion of this spirit that lies nearest to it at the rate of 17 miles per minute at the Equator, and at a gradually diminishing rate towards the Poles; or, it comes to the same thing to say that the Genie traverses the surface of the Earth at this rate along the parallels of latitude from West to East. One result of this is that the whole army of magnetic imps throughout the world that have, from their size and constitution, the requisite freedom of movement, must continually assume the rectangular or military position towards their great chief; in other words, they will point in the direction of the terrestrial Poles,—a permanent and invaluable phenomenon, which, utilised in the guise of the mariner's compass, constitutes one of the greatest blessings to mankind. As a curious presumptive corroboration of this idea, a well-known experiment may be called to remembrance. If a rod of soft iron be suspended at right angles to the electric or magnetic current,—that is to say, nearly north and south,—with a considerable dip to the north, and smartly and repeatedly struck, so as to put its particles in a state of vibration, these particles, or a certain portion of them, will assume the deferential or military attitude, and retain it *permanently*, along with the magnetic power which it confers, thus converting the rod into a magnet.

This powerful Genie does not disdain to act the part of a most useful and obedient servant or slave to mankind. Without his spontaneous assistance, as the fermentative agent, the processes of baking and brewing could not be successfully carried on. In the nutrition and growth of plants he acts a very important part, and, as the late Sir Charles Siemens has experimentally proved, can be used artificially to expedite and improve their fruit-producing powers to an extraordinary extent. He can, by a little skilful management, be made to work sewing and other

domestic machines; to ring bells of warning at any distance that may be required; to transmit messages to any distance with accuracy, and with a promptitude that no human messenger could equal; to act the part of a watchman, and give instant warning of the approach of burglars or thieves. He can send warning to a distance of the escape, and anticipate the movements, of criminals, so as to lead to their apprehension, and thus prove a powerful aid to law and good government. He will even detect the outbreak of fire, ane give timely warning of it. He transmits true time, and keeps our clocks in harmony with each other in all parts of the kingdom. He gilds and plates our spoons and metallic goods; he reproduces to any extent our medals and works of art, including the most valuable engraving plates. He can, at a safe distance, detonate the charges used in quarrying and mining, and can explode torpedoes and other explosive contrivances, whether used for warlike or peaceful purposes.

Dr. Bain suggests that he should be employed by schoolmasters for inflicting the various degrees of punishment required in public schools; and it has been proposed that he might with advantage be made to perform the office of public executioner, and by an instantaneous and certain death to do away with the hateful and sometimes bungling services of that functionary. He affords to scientists the means of collecting from and transmitting to all parts of the world invaluable and timely information and warning in regard to passing events, and notably to the state of the weather and the approach and the direction of storms, so as, in many cases, to give time and opportunity for the avoidance of the dangers arising from them.

There is a gentleman (Mr. Robert Davidson) still living in Aberdeen, and whom I have the pleasure of calling my friend, who, forty years ago, constructed an electromotive machine which was tried on the Edinburgh and Glasgow Railway, being the first attempt of the kind; but the speed attained was so far below that of the steam locomotive that the undertaking had to be abandoned, and it had no practical results at the time. And even yet, though there are one or two electric railways in operation on the Continent, there is no indication shown that the present arrangement will be superseded for many years to come.

These are only a few of the numberless benefits for which we are indebted to Electron. But there is one department of public and domestic importance where his services are available, and where they are destined—possibly at no distant

date—to add another contribution to the welfare and happiness of the world: he can be made to assume the character of an angel of light, and to give forth, by self-ignition, an unlimited amount of light, of a beauty and quality, and freedom from noxious effluvia, superior to any artificial light that can compete with it.

There are various ways in which the Magi and other operative assistants have been able to effect this transformation, but the usual and the most efficient is by making use of the intervention of another Genie, whom scientists have much more completely under their command. This Genie, though belonging to a lower order of beings, has within the last hundred years been proved to possess capacities—and has had them practically employed—for the promotion of the power, civilisation, and enrichment of mankind, to an extent that is apt to mislead the ignorant into a belief that he is equal, if not superior, to Electron himself. He may be described as a hybrid, generated by the impregnation of water by Electron, and is invisible, like his father, but, like other beings of semi-terrestrial origin, is continually tending to return to the form and substance of his mother. He is the most extensively known and powerful of a large class of similar spirits, the result of the intrigues of Electron with nymphs of terrestrial lineage, and he derives his energy and strength from his father, and his pliancy and instability from his mother.

Vaporin, as he may be designated, can, by the connivance of men, be generated within strong iron closed vessels; and by the continual and powerful efforts which he makes to escape, and the strength he puts forth while making his escape, he can be made to do almost any kind of mechanical work through the intervention of connecting belts or chains, and of ingenious and appropriate machinery. Well, this Vaporin Genie can be made to rouse the nobler spirit of his father into violent excitement by driving to and fro, across his path, a number of electro-magnets, at the rate of several hundred times in a minute, and thus compelling him, in accordance with a law which is binding upon him, continually to respond to the salaams that are made to him by these electro-magnets. And in the pathway to the magnets there can be placed small gaps or interruptions in the form of some material, such as carbon, which he can pass through only with difficulty. And so, at the points where he has to cross these obstructions, the struggle that ensues betwixt him and the atoms of the carbon is such as to send forth a flash of light that can be compared only to that of the sun itself.

The light produced in this way, then, though it appears to be continuous, is in reality only a succession of rapid flashes, running, as it were, into one. In this magical transformation of electricity into light the part performed by Vaporin is merely that of a mechanical slave, and which could be performed almost as well by the force of gravitation, by wind or water power, or by muscular strength.

Though it has suited the drift of this paper to view Electron as a spirit specially belonging to the Earth, where we can most readily perceive and understand his agency, there can be no doubt that he extends throughout, and fills the universe itself, or at all events that he is co-extensive and homogeneous with light itself, which we know reaches us from the most inconceivable depths of space. And if we can only speculate in regard to most of his operations here, how little can we know, or even conceive, of the entire purposes for which he is employed by the Almighty Architect?

If we can imagine any part of space to be devoid of matter, *there* Electron would exist in his pure and primitive condition as a pure spirit. But with his power of motion (at the rate of 576,000 miles per minute), wherever he comes in contact with the innumerable accretions of matter, whether great or small, so profusely scattered through space, he would become imbued with some minute portion of it; and this, of course, is the form in which we have our experience of him. In some conditions of matter, as in the sun, for instance, through means of the commotions and rearrangements in it which are continually taking place, and in which *he* no doubt plays an important part, he would become imbued with a still larger—though yet inconceivably small—portion of it. And when reflected back from the sun, and now assuming the form of light, his motion would be retarded to one-third, or 192,000 miles per minute. The matter or material undulation thus diffused through space reaches our own planet, its motion being still further retarded by our atmosphere, in a form too attenuated to be identified by the most delicate chemical tests, though recognisable by the spectroscope. Yet, minute as it is, I believe it is continually contributing to the growth, and the health, and the beauty of all living things, as well as producing important changes in the inorganic world.

An ingenious—and it may be said mysterious—instrument, the Radiometer, invented by Mr. W. Crookes, F.R.S., seems to afford confirmation of the idea of the material character of light. It consists of four thin square aluminium plates, weighing about 2 grains, attached to and projecting at right

angles from a slender shaft of the same metal, and kept in position within a glass vessel from which the air is exhausted. The plates are bright on one side and blackened on the other. When exposed to light or to heat the shaft moves with a constant rotary motion, the most probable cause of which seems to be the impetus given by the undulations of light or heat impinging upon the bright sides of the metallic discs, while their dark sides attract and absorb its material (?) constituents, and are thus drawn towards it, so that the bright and the dark sides, thus differently acted on by the light, co-operate together in producing the constant rotation. The friction or resistance of the atmosphere being removed, and the pivots on which the axis moves being very fine, the slightest possible force is sufficient to cause the motion. When we see the tremendous force exerted by so rare and delicate a substance as atmospheric air, when put in rapid motion, we need not be surprised at the effect produced in this instrument by the momentum caused by the immeasurably greater velocity even of what are so imponderable as the waves of light. But strange to say, when the vessel is made as empty as it is possible to be made, by chemical means, the motion becomes turned in the opposite direction—a phenomenon for which, though it may be difficult to account, I would venture to give the following explanation:—As long as any matter remained diffused, probably in the form of aqueous vapour in the Torricellian vacuum of the glass vessel, its affinity or attraction for the light would draw the motion in the direction that has been described; but when this element in the case had been withdrawn, the omnipresence of Electron, with *his* more rapid motion and his preference for the bright side of the metallic discs, would associate the light with himself and attract the bright side of the disc, and thus draw them in the opposite direction from what the light itself did. By entering into the vacuum in the glass vessel, and being released from the compression of the atmosphere, whatever material atoms might be in union with Electron would have their mutual repulsion greatly augmented, and their undulations being thus driven against the bright sides of the discs, so as to cause their movement.

There may be other ways of explaining the action of this curious and suggestive piece of apparatus, but they all tend to confirm the idea of the existence of matter in a radiant and inconceivably minute condition, diffused through space, —in fact, the old and never yet abandoned idea of a universal ether.

That no discovery should have been made hitherto of this radiant form of matter in all the analyses that have been made of atmospheric air is not to be wondered at. There are, indeed, more things in heaven and earth than are dreamed of in our philosophy. Organised and living ova, or germs of many kinds of living organisms, which are now believed—indeed proved—to exist abundantly in the air, and to subserve important functions in Nature, were never, nor can even yet be *visibly*, detected in it. And how inconceivably small must those odoriferous particles be which we recognise by our sense of smell! The particles of the scent of game, or of a man's footsteps, for instance,—consider how minute they must be to be spread for miles across the ground so as to serve as a sure guide to the dog, who is still more highly endowed in this respect than man. How infinitely numerous and minute these atoms must be, and how completely beyond the power of detection, except through the special sense of smell with which God has provided us! And so the electric or "radiant" matter, as it is called by Mr. Crookes, in an inexpressibly attenuated form, is far more likely to have escaped detection. But if we have faith in this very feasible theory of the universal diffusion of matter, we may find ourselves in a better position for seeing and understanding, to some small extent, God's method in the creation and government of the world.

Taking therefore for granted the existence of radiant matter, or ether,—or chaos, as some might call it,—we must also admit the probability that this ether is continuous through space,—throughout interstellar space, we may say,—and that it contains in itself the materials out of which all things were and are made: the stars, worlds, comets, aërolites, and whatever is gyrating and circulating through its vast ocean. If the *proportion* of matter thus held in solution by Electron be inconceivably small, yet as it extends through a space that is, we may say, infinitely great, and is also continually replenished by his solvent power, it may therefore be admitted to be sufficient in amount for the stupendous purposes we have supposed. Out of the matter thus diffused through the ocean of space we can readily believe all things to have been made, the ether itself having been, "*in the beginning*," *created*, but "without form and void," by the fiat of God Himself.

The identity—or rather homogeneity—of the material of which the universal Cosmos is composed may be also inferred from the composition of those aërolites which are from time to time projected, or rather I should say drawn, by gravita-

tion, upon the earth, the substances composing these being found to be quite identical with the components of our own planet. Electron may thus be said to make all the Universe kin, and its inhabitants bone of the same bone, and flesh of the same flesh, as ourselves; although the type and model of their physical organisation may be very different,—indeed must be so,—in conformity with the diverse influences affecting them in respect to gravitation, distance from their central suns, periods of their solar circuits, physical or geological condition, of the planets, and other astronomical elements. But still we are all formed of the same materials, energised and vitalised by the same electric energy, the same light, and the same heat, and are alike the subjects and children under the government of the same supreme Sovereign.

(To be continued).

V. THE ORIGIN OF SPECIES FROM MONGRELS BETWEEN RACES AND OTHER SPECIES.

THE following researches by Herr W. O. Focke, which have appeared in the "Botanische Jahrbücher" and "Naturforscher," though relating primarily to plants, extend in principle to the entire organic world, and must be welcomed as throwing new light on a question still beset with difficulties.

The assumption that new species of plants may in the course of generations be evolved from hybrids has latterly gained increasing probability in consequence of various observations. Still the influence of hybridism upon the origin of species has been hitherto, in general, regarded as quite subordinate. This view Herr Focke combats in his memoir. A careful study of those genera and groups of plants in which numerous transition-forms obliterate the boundaries between the more decided species has led him to the conviction that the ordinary Darwinian view of the origin of species is no longer sufficient. According to Darwin most species have originated by the gradual modification and differentiation of the primitive types. In accordance

with this view the occurrence of polymorphous forms can in many cases be explained by adaptation to modified climatic and local circumstances. Thus the development of the manifold forms in the group *Viola tricolor*, where we find the most distinct forms adapted to distinct local conditions, can be very well comprehended on Darwinian principles. But for the explanation of polymorphism in other groups of plants the principle of variation and selection proves insufficient. As an example we may take the blackberries (black-fruited European *Rubus*). Herr Focke entered upon the study of this group as early as 1857, *i.e.*, prior to the publication of Darwin's great work, with the purpose of detecting, if possible, the process by which species originate. In this rich group, although the individual forms chiefly belong to well-defined races or species, all stages of the process of the formation of species are well represented. The fertility of the different races varies as greatly as the structure of their pollen. In development of characters, in independence, or connection with kindred forms there occur all imaginable differences, so that we cannot conceive of any grade between the variety and the "good species" which is not to be found among the blackberries.

Particular attention must be given to the texture of the pollen in the different forms of blackberry. Some few, such as *Rubus cæsius* (Linn.), *R. ulmifolius* (Schott), *R. tomentosus* (Bœck), have a perfectly well-formed pollen. In others we find a mixture of the granules,—*i. e.*, among sound pollen-grains there is a greater or smaller number of misformed useless particles. Such a degeneration of the pollen may be due to the influence of an unfavourable climate or to defective nutrition. But all the blackberries are characterised by their wide distribution, their remarkable constancy, and their relative independence of soil and climate. Whilst among the blackberries one and the same race readily adapts itself to very different local conditions, we find, on the other hand, on one and the same spot of ground a great number of different races growing promiscuously. It seems, therefore, impossible to assume that the partial failure of the pollen is here a consequence of abnormal vital conditions. We must rather suppose that, as in numerous other cases, the heterogeneous condition of the pollen is connected with a hybridity of descent. That the blackberries do in fact very frequently produce hybrids is certain. *R. cæsius* fertilises all the other species with which it occurs in common, and, like various other species, is always accompanied by its hybrid progeny.

It has often been doubted whether permanent species can arise from hybrids. Hybrids between species mutually remote from each other are often sparingly fruitful. But we often find, *e.g.*, in *R. cæsius* and *R. tomentosus*, in favourable localities, all intermediate links between sterile and fairly fruitful specimens. Observation further shows that with time fruitful races can originate from hybrids of sparing fertility. The original lack of permanence in hybrids, as numerous observations prove, loses itself often entirely in successive generations. Many examples are also known where hybrids artificially produced agree exactly with naturally occurring "good species." Some of the sparingly fruitful hybrids obtained by Herr Focke by sowing the fruits of *R. cæsius* and *R. idæus* cannot be distinguished from the Swedish species, *R. pruinus*, and the Pomeranian *R. maximus*. The locally distributed blackberries are certainly in great part mixtures of races growing in the same district. On the other hand, it is certain that many species and races with mixed heterogeneous pollen cannot be descended from hybrids of known living forms. To be consistent we must still assume that these are also hybrid forms, but that their origin extends far back,—in case of *R. fruticosus*, *e.g.*, as far as the Tertiary epoch. On the other hand, the species with homogeneous pollen may be regarded as of unmixed origin. From the circumstance that the *Rubus* seeds are often carried about by animals, and from their great adaptability, a local mixture of species will easily have occurred, even though under certain circumstances the immigrant forms may have been subsequently displaced by their competitors.

In the struggle for existence vitality and adaptability generally determine the result. Since in this respect, as Darwin has shown, individuals of mixed origin are generally better off than their parents, it is not merely conceivable, but even probable, that hybrid races may survive their ancestry. The disadvantage of a heterogeneous granulation of the pollen is comparatively of little weight.

If we now consider that the majority of our cultivated plants have been produced by crossing, whilst all our art and all the exaggerated influences of soil and climate have not been able to effect much change in given natural species, we shall not be able to resist the conviction that the crossing of species and races has a greater effect in the formation of new species than has been hitherto credited. The prejudice which uncritically ascribes all creative influence to the soil and the climate alone must be overcome.

In order that mixtures may spring up in Nature decided

races must first be formed, as happens by isolation and in-breeding. By crossing the stock attributes of the form are increased, since new properties appear in the hybrids and in their offspring which are added to the sum of the attributes of both parents. A richly varied material is thus obtained by crossing kindred species or races.

On the basis of the following four facts given by Darwin—(1) the greater vitality of mongrels; (2) their variability; (3) the selection of the most suitable types of variable forms; and (4) the survival of the most suitable and highly vitalised forms—it may be maintained that in the rule the specific types of the future will appear among the descendants of mixed races. But as there is no absolute boundary between varieties and species, there can be only a graduated difference between the origin of species from the hybrids between species, and that from the hybrids between varieties.

The views thus developed concerning the origin of species differ only in appearance from those of Darwin. Their import lies merely here,—that they extend the vision of the inquirer who seeks to understand the causes and the nature of Evolution.

VI. THE HEALTH EXHIBITION.

No. II.

ON revisiting this display we certainly found not a few objects of interest which we had either overlooked on previous occasions or which had been recently added. At the same time our first impression—to wit, that many of the articles on view had but a very remote and doubtful connection with health, and were consequently here as intruders—was strengthened.

The models representing portions of old London are now complete, or nearly so. But whether, when compared with modern structures, they give us quite as much scope for self-congratulation as is rashly assumed, is, to say the least, not proven. The London which they represent was certainly

unsanitary. But it had this defect, not in virtue of the style of architecture then in vogue, but by reason of the narrowness of the streets, the absence of drainage, the presence of cesspools within doors, and the dirty habits of the inmates. Supposing all these drawbacks removed, there is no reason why houses constructed as in the specimens before us should not be, to say the least, as favourable to health as the most monotonous row of villas or "desirable residences" ever run up by a modern jerry-building speculator.

The "Journal of Science" is not an organ of art, and we have therefore no call to enlarge on the superior æsthetic character of these dwellings of our forefathers. But we may at least ask whether the increasing monotony or uniformity of our domestic architecture and of our modern costumes is not evidence of decreasing specialisation in modern life? We know that this view is not in accordance with the teachings of so eminent an authority as Mr. Herbert Spencer; but we fear it is borne out by facts of many kinds.

In our last notice of the Exhibition we regretted the apparent absence of models showing the evils due to the sin of tight lacing and to the use of high-heeled boots. We are glad to own ourselves mistaken. There are models, in plaster, of the liver of a healthy woman and of the same organ in a wasp-waisted votary of fashion. Along with them are models of the feet of wearers of high-heeled, narrow-toed boots, as compared with the normal female foot. The crippled and distorted members are, in good sooth, ugly to the very verge of repulsiveness. But what must we think of a writer who seeks to argue that these self-inflicted deformities are at bottom the fault of the male sex, and especially of "man doctors"? Yet the writer even contends that such absurdities would vanish if ladies would exclusively consult medical women! Our acquaintance with the profession has been somewhat extensive, but we never met with a medical man who did not protest against tight-lacing and other vagaries of fashion, and who did not carry his remonstrances to the point of occasionally offending foolish lady-patients. The notion that ladies dress to please men we have often heard utterly scouted by the fair sex, as simply a "piece of masculine conceit." Nor do we believe that the normal man, of any grade of culture, admires debility in woman, even if it is wrapped up in the deceitful term "delicacy." When he does it is a sign that wholesome instincts, which may be traced far down the zoological series, have been eliminated from his nature by mistraining and morbid public opinion.

The bulk of the exhibits in the section of dress, however interesting to the historian and the sociologist, have but a very remote connection with health. One thought struck us as we gazed upon the figure and costume of a fop of the early days of George III., now more than a century ago, concerning the evidently thin texture of the garments then worn by men. Very few of us could, save on a few exceptional days in summer, endure the cool clothing of our ancestors. Were they more tolerant of cold than are we, or are the seasons less genial?

Another point is the wide range of colour then permissible in male costumes, as compared with the present narrow limits. But to this we have already referred as a case of anti-differentiation.

In this same dress-department, or gallery, or whatever else it may be named in the modern language of Exhibitionists, we noticed not a few articles interesting enough in themselves, but surely out of place. Thus there was a glass case of dye-wares, unlabelled. We noticed indigo, safflower, turmeric, gall-nuts, catechu, and several of the aniline dyes. But fascinating as are the tinctorial arts, as one of the highest developments of applied chemistry, it is doubtful whether they contribute much to health. It may even be suspected that the dyed or printed garment conceals dirt which the fibre in its original state would betray.

Glove-making is in full operation for the instruction of visitors. But the glove, save in severe weather, is not a sanitary appliance. It is merely an incumbrance with which Mrs. Grundy compels us to shackle ourselves all the year round, but which men of sense are eager to throw off if no one is looking.

Among the long series of grates and stoves for cooking and warming houses, we came upon a model and specimens illustrating the Jameson patent process for coke-burning with utilisation of the volatile products, now allowed to escape into the air. There was no one in attendance, but from the labels we learnt that from a ton of coals burnt there are obtained oils to the extent of 5·65 gallons and 2·7 lbs. of sulphate of ammonia. Concerning the value of the oil it is difficult to hazard even a guess without knowing whether it is rich or poor in benzol, toluol, anthracene, &c. The yield of sulphate of ammonia is not encouraging. To obtain a ton of sulphate of ammonia, worth at present £15 15*s.*, there must be burnt nearly 828 tons of coal, and from the returns must be deducted the value of the sulphuric acid required to absorb and combine with the ammonia. If,

however, we consider the enormous quantity of coal yearly converted into coke, it is to be greatly regretted if even so small a proportion of recoverable ammonia should be allowed to go to waste. If the coke obtained is of good quality, and the working cost is low, the process may be, as we heartily hope, remunerative.

In a court displaying objects of art from India—beautiful, indeed, but altogether beside the question—we noticed an interesting exhibit of the tea-culture of India. There are specimens, in pots, of the varieties of the tea-shrub chiefly cultivated in India, and, looking not too happy in their imperfectly-lighted locality; there are samples of the produce, and there is an elaborate map of the empire showing the tea-producing districts, whilst a statistical diagram shows the rapid manner in which the consumption of Indian tea is gaining ground upon that of China.

Amongst the recent additions to the Exhibition is the display of the London water-companies. We see there specimens of the water furnished, models of filter-beds, sections of mains, and, in short, all the appliances for earning heavy dividends. But there is no feature from which an anxious public may learn when the long-hoped-for reform in the Metropolitan water-supply is to be effected, and when we shall no longer be called upon to pay at a higher rate for water because our rents, rates, and taxes have been raised!

In our last notice of this Exhibition we ventured to express our regret that the influence of worry and anxiety in promoting debility could not be brought home to the British public. We find, however, that on August 4th a "Conference" will be opened, in connection with the Exhibition, on the bearings of education upon public health. The Conference is to continue for a week, and its discussions are to be arranged under the following heads:—

1. Conditions of healthy education. 2. Infant training and teaching: *a*. Kindergarten; *b*. Instruction generally. 3. Technical teaching: *a*. Science; *b*. Art; *c*. Handicrafts; *d*. Agriculture; *e*. Domestic economy. 4. Teaching of music in schools. 5. Museums, libraries, and other subsidiary aids to instruction in connection with schools. 6. Training of teachers: under this head will be considered the right professional preparation for teachers in—*a*. Elementary; *b*. Intermediate and higher; *c*. Special and technical schools. 7. Inspection and examination of schools: *a*. By the State; *b*. By the universities; *c*. By other public bodies. 8. Organisation of elementary education. 9. Organisation of

intermediate and higher education. 10. Organisation of university education. 11. Systems of public instruction in various countries.

What will be the conclusions reached we do not venture to forebode. Perhaps we shall be told, on the authority of amateur biologists and psychologists, that anxiety and work under pressure, especially in childhood and early youth, are conducive to health; that "cram" is not merely salutary, but is the only way to train up eminent discoverers and inventors. Or, perhaps, we may confess that we have been going year by year more widely astray, and that our educational arrangements, if the "wonder," are scarcely the "envy" of the civilised world.

VII. THE EXTRACTION OF GOLD.

"And is not gold the god of earth."
P. J. BAILEY.

IT is in these days justly and generally considered as a humiliating failure if in any industrial operation we do not secure practically the whole of the valuable products. The farmer seeks to reap and garner in the entire crops which have grown and ripened on his acres. If prevented by bad weather he bewails his bad luck if foolish; and if prudent and energetic, he secures a Gillwell harvest-drying machine. The manufacturer, of every kind and grade, is always on the alert to utilise the whole of the raw materials which enter his factory, and if any waste products are formed he moves heaven and earth to turn them to account, or to extract from them some portion at least which may have a market value.

Instances of the success of such endeavours are familiar not merely to practical men in any department, but to the whole reading public. The prevention of waste and the utilisation of refuse, from coal-tar down to the waste soap-suds of the woollen mills, have served "to point a moral and adorn a tale" almost to weariness.

Such being the undoubted tendency of the age it may strike us as strange—as scarcely in fact credible—that in an

important metullurgical process fully one-half of the substance sought for is, in these days when Science and practice are supposed to walk hand in hand, still allowed to go to waste. It will not lessen the surprise of our readers on learning that the material thus wasted is—gold!

So unexpected is this statement that we think it necessary to present briefly the testimony of mining engineers, assayers, and others of long and special experience. Thus Prof. Jack, Geologist to the Government of the Colony of Queensland, says:—"I believe that from 50 to 90 per cent of the gold contained in some of our complex ores is being lost."

From California, and from the gold-mining districts of America generally, comes substantially the same complaint. Of this we may be convinced on reading over the last Report issued by the Directors of the United States Mint, at Washington. In this Report we find the testimony of Mr. B. Paul, one of the oldest and best mining authorities of California. He says—"As far as California is concerned I am satisfied that not more than 40 per cent of her gold is extracted [*i.e.*, 40 per cent of all contained in the stone that has been treated]. . . . . Our present general system of mining is based upon the idea that gold is mainly coarse, while examination will show that the high percentage is in atoms finer than flour itself. In my experiments gold has been taken up so fine that it would not subside in distilled water in less than from five to ten minutes." He asks further, "Can you save gold of this kind by running water down stream? Can you obtain gold of this kind without minute reduction? Therein lies the secret of high assays before working and small returns after."

Prof. Eggleston, one of the most eminent metallurgical chemists of America, calculates the loss at "between 50 and 60 per cent" of the total gold present in the ore operated upon.

Mr. C. S. Dicken, F.R.G.S., in a paper read in March last before the Royal Colonial Institute, quoted the amount of gold actually contained in the "Disraeli pyrites" from the Charters Towers District, Queensland, as being on an average 4 ozs. 14 dwts. 13 grains per ton. But the quantity of gold actually obtained from this ore on the present system is only 1½ ozs., or a loss of 70 per cent. Another Queensland sample, Mr. Joske's "Ravenswood pyrites," gives on assaying 2 ozs. 18 dwts. 19 grs. of gold to the ton. But on the ordinary system of working it cannot be treated at all at a profit, and is hence lying idle.

In short, summing up all the facts and all the other evidence bearing upon the question, we can only re-affirm the statement made in a former volume of the "Journal of Science," that "when treating the most tractable of the sulphurets, battery amalgamation (*i.e.*, the process at present in use in California and Australia) does not secure more than 45 per cent of the gold."

We may here glance at the change which has latterly come over gold-mining and gold-finding in general. When the auriferous fields of California and Australia were first opened up, the precious metal was obtained in nuggets of different sizes, and in grains or sand, which, though small, were distinctly visible to the naked eye. These grains and nuggets were obtained by washing, and subsidence from the sands, gravels, and other *detritus* resulting from the weathering of auriferous rock. The process was simple, and required little of either capital or metallurgical skill. But these washings or diggings have been practically exhausted. Whether similar deposits may or may not exist in Central Africa, in New Guinea, or in unexplored parts of South America, is not here the question.

The gold-miner has now to go to work in a more systematic manner. Quartz reefs—*i.e.*, beds of quartz rock containing auriferous pyrites—occur sometimes near the surface, but sometimes only at considerable depths, and, contrary to a popular notion, these reefs do not necessarily become poorer the deeper the miner descends, but very frequently richer. Hence the ordinary practice is now to sink down to or below the reef, to drive levels, break up the stone, and send it up to the surface for further treatment.

This gold-stone, however, differs not merely in the percentage of gold contained, but in other features which have a very important bearing upon the process of extraction. Where merely quartz rock and iron or copper pyrites accompany the gold and silver, the process is comparatively simple; but when, as is often the case, the sulphurets of antimony, lead, zinc, &c., occur, there is great difficulty, waste of the mercury used, and a loss, as we have seen, of the greater part of the gold demonstrably present in the stone.

The method of extracting the gold from the stone may be found described in full detail in every text-book of metallurgy; still, for the better understanding of what has to follow, it is here described in outline. The lumps of quartz rock are ground up, by means of stampers with water, to such a degree of fineness that it can pass through a sieve

containing 225 apertures to the square inch. It is then ground up with mercury, and washed over a series of amalgamated copper plates and flannel filters, by which the gold is supposed to be arrested. In reality very much of it, as we have seen, escapes. The powder of the rock is far too coarse; many minute particles of gold—locked up, so to speak, in the centre of these particles—escape the action of the mercury altogether. Much of the gold, too, amalgamated or not, floats away on the surface of the water, and is lost. Hence Locke, probably the first authority on the subject, though he did not see his way to doing away with the use of water in the extraction of gold from quartz stone, calls it "the greatest robber."

Further, by grinding up with the wet mass no small portion of the mercury is rendered "sick," as the technical term is. In this state it is incapable of readily combining with metallic gold or silver, and floats away on the surface of the water in a fine film. This sickening or killing of the mercury is very much promoted if a little oil or grease from the machinery finds its way into the amalgamation-pan. If anyone wishes to see what sick mercury is, he need only grind a little of this metal up in a mortar with water and fine sand or earth. If he continues this process long enough he will find that the metal loses its tendency to run together in globular drops, and can only be collected together with great difficulty.

The water also facilitates the action of sulphurets of antimony, &c., upon the quicksilver. Sometimes, indeed, where these ingredients are abundant, the whole, as the miners term it, gets into "a mess," from which neither the gold can be extracted nor the mercury recovered on paying terms.

In consequence of the deficient yield of many of the kinds of quartz rock, and the practical impossibility of working others at all, some of the mines in Queensland have been abandoned, and others are carried on at a profit far below what they ought to yield. At the same time the "tailings" or residues of ore which have been ground and submitted to the amalgamation process have accumulated to the extent of many thousands of tons. These tailings still contain a very fair proportion of gold, as is proved by the assay, but they cannot on the ordinary principle be reworked at a profit.

In consequence of this annoying state of affairs Mr. W. Pritchard Morgan, a North Queensland mine-owner, and Mr. J. Needham Longden, an Australian mining-engineer

and metallurgical expert, came over to London about a year ago to consult with the leading British and Continental metallurgists, and to devise, if possible, some more excellent way. After many, and we may say costly experiments, they came upon a totally new process, which in the opinion of the best judges, and, what is more, in actual trials on the large scale, bids very fair to get over the difficulties which we have above enumerated.

The inventors propose, in the first place, to comminute the ore not in a wet state, but perfectly dry. The pulverising process is effected not by means of a battery of stampers, but by means of a "Jordan" pulveriser. This apparatus acts not by grinding or stamping, but by impact or concussion, something after the manner of a Carr's disintegrator. The stone is reduced to a powder as fine as flour, so that it passses through a sieve of 8100 meshes to the square inch, or, in round numbers, forty times as fine as is done in the old process. Hence all the loss dependent on the circumstance that much gold remains still locked up within the grains or fragments of quartz or pyrites is got rid of. The use of water is dispensed with entirely, and though the pulverising is so much more perfect it is effected at an average cost of 8*s.* per ton, as against 16*s.* 6*d.* per ton by the stamping process, so that here already there is a saving of 8*s.* 6*d.* per ton.

We come next to the amalgamation. The mercury is applied dry and hot. The ore, reduced as above to an impalpable powder, is passed upwards through a column of heated mercury 30 inches in height, and during this passage it is kept constantly distributed through the mercury by an ingenious self-acting apparatus. The details of this part of the process can not be intelligibly described without the use of plates, or, better still, of a working model. We can merely say that the ground ore is fed into a hopper at the top of a revolving tube. Passing down this it is centrifugally forced into the mercury, and would then, in consequence of its lower specific gravity, at once rise to the surface. To prevent this too rapid escape it is constantly agitated in the mercury by a set of revolving blades. These can be adjusted in their number, in their speed of rotation, and in the angle at which they are set, so that the pulverised ore can be kept in contact with the heated mercury for a longer or a shorter time, according to the quality of the stone which is being operated on. A steam jacket outside the pan maintains the mercury at the temperature desired. When, finally, the ground ore reaches the top of the column

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of mercury, it meets a strong blast of air which blows it across the concentrating chamber. "The particles of sand fall in different parts thereof in accordance with their specific gravity, the light waste being conveyed by the air-current to a waste-pipe which conducts it away."

It will, of course, be evident that as any particle of gold combines with the mercury to form an amalgam its specific gravity is increased, and it falls down to a conical receptacle in the bottom, where it can be let off from time to time as convenient.

It is scarcely necessary to insist on the vast advantages of this method of amalgamation over the old wet process. The mercury, hot and dry, comes into immediate and close contact with every particle of gold or silver present, which can hence scarcely escape without amalgamation. The water is no longer there to interfere or to carry away fine films of gold upon its surface, the mercury does not become sick, and the whole process is completely under control.

We must, however, beg leave to make one suggestion: so far, as we perceive, the inventors purpose using pure mercury. We submit that, especially in cases where antimony sulphides, &c., are present, they would find it advantageous to use the sodium-amalgam, first proposed by Mr. W. Crookes, F.R.S., and which has done good service in the hands of metallurgists in various parts of the world. The quantity of sodium which has to be added is so minute that it would neither appreciably increase the working cost nor modify the specific gravity, the fluidity, &c., of the mercury. Consequently the mechanical arrangements for distributing the ground ore through the mercurial column would remain the same.

Passing, however, from considerations of what should or must be, to the records of actual experience, we find the teachings of theory fully borne out in practice. In conjunction with Messrs. Jordan, Son, and Commans, the mining engineers, of 52, Gracechurch Street, the gentlemen previously named have had an extensive plant for the extraction of gold erected at Stratford Market, and have there put their process to the test of work. It has been found that the "Disraeli pyrites," mentioned above as yielding in Queensland, by the old process, 1½ ozs. of gold, or 30 per cent of the contents as per assay, gives by the new process 4 ozs. 5 dwts. 11 grains, or 91 per cent—a clear gain of nearly 3 ounces. Mr. Joske's "Ravenswood"

pyrites, mentioned above as found to be incapable of treatment in Queensland, yielded 2 ozs. 12 dwts. 20 grains, or 89 per cent of its total contents. This increased yield of the precious metal is obtained, further, not at an increased but at a diminished working cost.

In addition to obtaining a greatly improved production at a reduced outlay, there are certain collateral advantages which must not be overlooked. In the first place water is dispensed with. This, in a country like Britain, may seem a trifling point; but in many gold-fields—in Australia, California, and South Africa—water is often very scarce, and the introduction of a process in which it is not required will be no small boon to the mining communities.

Another consideration is that the process is self-acting. The amalgamation apparatus may be locked up in a strong room, and will go on with its duty undisturbed. Thus there is neither opportunity for pilfering, nor are the men exposed to the fumes of mercury.

Though this invention emanates from persons more directly connected with the gold industry of Queensland, we must not for a moment suppose that the process is applicable there only. In other parts of Australia, in California, Mexico, &c., the very same conditions prevail, and the same waste is going on, for which we have here the remedy. It must especially be noted that though many samples of quartz from the Wynaad, and other districts of India, are found when assayed to contain fair, and even large, percentages of gold, yet the mines in question are not remunerative. We are surely warranted in believing that this new process is the condition needed to make these mines commercially successful.

It is estimated that at present the annual output of gold for the whole world is £20,000,000. Now if we leave out of view the inferior stone, the waste ores, and the accumulated heaps of tailings, we may form some idea of the value of a process which, if generally put in practice, must increase this yield by at the least 25 to 30 per cent.

The process has been patented in all countries where gold-mining is likely to be carried on. The patents for the United Kingdom (No. 5235, November 5th, A.D. 1883, and No. 5236, of the same date) are taken out in the respective names of Thomas Rowland Jordan, and of Thomas Rowland Jordan and John Needham Longden. To these specifications we must refer our readers for further particulars.

In pronouncing this new process one that will make an epoch in the metallurgy of the precious metals as signal, doubtless, as that due to Sir H. Bessemer and to Messrs. Gilchrist and Thomas in the treatment of iron, we must not omit to point out that we have taken every precaution to assure ourselves of the *bona fide* character of the invention. With fair play it will especially add greatly to the prosperity of Australia and of India. It deserves, therefore, a full and a candid examination.

ANALYSES OF BOOKS.

The Wonders of Plant-Life under the Microscope. By SOPHIE BLEDSOE HERRICK. London: W. H. Allen and Co.

THE author of this ably-written work treats in succession of the beginnings of life,—an ominous subject,—of single-celled green plants, of fungi and lichens, of liverworts and mosses, of ferns, the physiology of plants, of corn and its congeners (among which are here included the orchids), "the microscope among the flowers," pitcher-plants, and insectivorous plants.

It will be evident, from this sketch of the contents alone, that Miss Herrick has sought not to furnish a systematic treatise on Botany, but to give a number of detached pictures illustrating some of the most interesting portions of the science.

In the first chapter the writer discloses her point of view, which is scarcely that of the modern biologist. She speaks of an "Intelligence which can and does fill every portion of this infinity of worlds with full, perfect, and exquisite life." We might, perhaps, ask Miss Herrick how she has ascertained that every portion of the universe is filled with life, and by what standard she measures perfection? She speaks of "the subtle scepticism of the human heart," of "the world in its innate unbelief," and of Science as being "its own antidote." Does it require one? Passing from these reflections, which we submit savour more of a tract than of a scientific treatise, she gives a clear account of the vegetable cell, and of its contents, protoplasm, "responsible for much bitter and rancorous warfare." But whose is in truth the responsibility?

This chapter concludes, perhaps with doubtful relevance, with certain comments on the relations between man and the lower animals. Says Miss Herrick:—"It is hard to find anywhere a deep chasm which separates our race from the myriad forms of life beneath if we ignore man's spiritual nature. On the physical side man is undoubtedly allied to brute nature, as he is on the spiritual side to the Divine." But if we grant a "spiritual side" to man, can we deny it to the lower animals? There is probably no faculty or emotion present in ourselves which in a lower grade is demonstrably absent in them. The very same arguments used in favour of man's continuance after death may be advanced also on behalf of "our poor relations." If the phenomena of Spiritualism prove that man is not solely material, they have shown the same concerning dogs and birds. The

introduction of this passage is the more to be regretted since it has absolutely no connection with the "wonders of plant-life."

The succeeding chapter, on single-celled green plants, is well written and admirably illustrated, most of the figures being drawn from Nature, we presume, by the author herself. But at the conclusion she raises the question as to the nature of the "vital force," and speaks of the theistic solution as "too simple, perhaps, for those who are bent upon looking back through millions of ages to the fiery gas out of which, they say, not only our worlds and systems of worlds have been developed." But such simple solutions cut off Science at its very root.

The chapter on fungi and lichens deals, among other low forms of plant-life, with bacteria, the muscardine of the silk-worm, the parasite which destroys flies, Listerism, and esculent fungi. *Phallus impudicus*, which is here misprinted *Phajus*, is strangely described as being of great beauty. The function of the lichens in decomposing rocks, and thus aiding in the great process of soil-making, has been omitted.

In discussing the ferns Miss Herrick speaks of "the most perfect manifestations of vegetable life." So, then, unless perfection admits of degrees, all plants are not "perfect," as was intimated in the beginning of the book.

In the chapter on corn and its congeners we find an Agassizian idea:—"The dim prophecies that have been struggling for utterance through all the language of vegetable life here find their fulfilment." Indeed, throughout all the work, we find no decisive evidence that the author accepts the principle of Evolution.

The fecundation of the orchids is described at some length. But Miss Herrick is too sweeping when she says—"To begin with, they are epiphytes or air-plants." She knows perfectly well that the orchids of cold climates grow in the soil like ordinary plants. On the same page we read:—"In Darwin's charming little volume upon the fertilisation of orchids, multitudes of forms are represented with an astounding number of variations of structure ('contrivances' he calls them, though he ignores the Contriver), to insure the cross-fertilisation of these plants." Perhaps it might have been more judicious if Darwin had written "quasi-contrivances"—a term which would have harmonised better with their origin on the principle of Natural Selection, and would have evaded the above-cited quirk on the part of one who owns herself so largely his debtor. We are very glad to find that Miss Herrick makes no attempt to deny hybrid fertilisation. She writes:—"There are many instances where a hybrid is produced by the fertilisation of one variety, species, or even—in rare and exceptional cases—genus by the pollen of another."

In a very interesting chapter on the pitcher-plants the author writes—"for a living representation of the mighty *Dinornis* of geologic times was subsequently found. If these words imply

that a living specimen of the Moa has been found, Miss Herrick is under a mistake. But a more important error is the assertion that "a development in one direction is invariably accompanied by a correlative development in another." Fossils have been found whose dentition and extremities would respectively assign them to widely different places in the Animal Kingdom.

A very curious fact is mentioned in the account of the pitcher-plants. A species of moth, *Xanthoptera semicrocea*, both in the adult and the larval state, possesses peculiarities which enable it to overcome the dangers encountered by other insects in the tubes of *Saracenia*.

In the following chapter, devoted to the more typically carnivorous plants, the author returns to Darwin, and prefaces an acknowledgment of the treasures of fact which he has given to the world with the words "however strongly we may and do dissent from his conclusions taken as a whole." This judgment is not very different from that which we must pass upon the work before us. As a statement of facts we can and do recommend it, but its theoretical portions are certainly not on a level with the science of the day, or in harmony with what we believe to be the truth.

Longman's Magazine. No. XVIII. April, 1884. London: Longmans and Co.

THIS number contains a "New Theory of Sun-spots," by Mr. R. A. Proctor. The author holds that the spots are regions of cooling and not of greater heat, and are probably due to the action of forces working from within expansively. If this view is correct a season of sun-spots must be a season of diminished heat radiation from the sun, and we on earth—and the denizens, if any, of the other planets—must suffer from cold.

If below the luminous surface of the sun there are regions of darkness, we may ask how does this fact agree with the nebular hypothesis? If the sun has been formed by the gradual condensation of a "fire-mist," surely its interior should be the hottest portion, or at any rate not the coldest.

It is further recorded here that on a certain occasion there was observed "an ejection of matter, solid or liquid (or if vaporous, then of great density), at velocities so great that the ejected matter could never return to the sun. . . . . In this case the ejected matter is now travelling, with velocity constantly diminishing, but never to be entirely lost, into the depths of interstellar space."

If the sun is thus in the habit of squandering his substance,

throwing out instead of receiving meteorites, his exhaustion as a heat- and light-giving centre may be perhaps a few million years nearer than has been surmised.

"A Pilgrimage to Selborne," by T. E. Kebbel, is thoroughly imbued with loving memories of Gilbert White. It is sad to think what changes have been wrought on the flora and fauna of even that peaceful district. Sad, too, that anyone unless a great naturalist should bear the title of "Lord Selborne." But we do not give peerages to men of Science in "this our highly-favoured country."

Mr. T. E. Kebbel writes:—"For it is not only the closeness of his observation and the extent of his knowledge in Natural History which delight us in his pages. The tone of satisfaction and contentment which they everywhere breathe; a love of and devotion to Nature, unbroken by that strife and trouble which nowadays penetrate to the remotest recesses of our island, . . . contribute at least an equal share of the pleasure which they inspire."

Twelfth Annual Report of the United States Geological and Geographical Survey of the Territories. A Report of Progress of the Exploration in Wyoming and Idaho for the year 1878. Part I. By F. V. Hayden, United States Geologist. Washington: Government Printing-Office. 1883.

This bulky, elaborate, and richly-illustrated volume contains the report of Dr. C. A. White on the Invertebrate Palæontology of the regions explored, that of Orestes St. John on the Geology of the Wind-River District, and of S. H. Scudder on the Tertiary Lake Basin of Florissant, Colorado. The second, or zoological section, embraces the report of A. S. Packard, jun., on the Phyllopod Crustacea, and the report of R. W. Shufeldt on the Osteology of certain American Birds, especially the Tetraonidæ and Cathartidæ.

We must first, however, notice Dr. Hayden's Preface, from which it appears that the present Survey must be regarded as definitely at an end. The sum voted by Congress for completing the publication of the results was exhausted by the end of June, 1882, and five volumes remain awaiting completion. This is much to be regretted. At the same time men of Science all over the world must admire the scale on which the Survey was conducted and the liberality shown in the distribution of its publications.

Perhaps the most interesting of the reports in this volume is that of the Palæontology of the Florissant Basin, probably the

richest locality in the known world for fossil insects. In a single summer it has yielded double the number of specimens which Heer obtained from the Œningen beds during thirty years. On comparing the produce of the two localities we observe a striking difference as regards the distribution of the different orders. In both the Orthoptera, Arachnida, Myriapoda, and Lepidoptera are very poorly represented; the Hemiptera are nearly equal in both; but whilst 48 per cent of the Œningen fossils belong to the Coleoptera, this order at Florissant includes only 13 per cent. The Diptera form 30 per cent at Florissant, and 7 at Œningen; whilst the Hymenoptera amount to 40 per cent in the former, and only 14 in the latter.

Among the Hymenoptera 70 to 80 specimens, representing about 30 species, have been found of wasps. A *Polistes* is remarkable as retaining traces of a greenish blue metallic tint. Another case of the survival of colour occurs in a specimen belonging to the Chrysidæ.

Of ants about 4000 specimens have been distinguished. Ichneumons, both small and large, are well represented, and prove the species of insects in which these parasites could oviposit.

One butterfly, in fine condition, has been described as *Prodryas persephone*. Two more diurnals appear, distinct from any living genus, but nearly allied to *Prodryas*.

The number of the Diptera—especially Culicidæ, Chironomidæ, and Tipulidæ—is remarkable, and proves that had man existed in the Tertiary epoch he would have found it by no means a golden age.

Among the Coleoptera two-fifths of the whole belong to the Rhyncophorous series, in striking contrast to what is observed in the European tertiaries. The water-beetles are not numerous, and there are no large *Dytisci*, as at Œningen. Silphidæ, Histeridæ, Dermestidæ, and Ptinidæ are few, pointing to a not over plentiful supply of animal refuse. Coccinellidæ and Telephoridæ are also scarce, whence we should argue that plant-lice cannot have been very abundant.

The Lamellicornes—or as our American friends prefer to call them, after the French fashion, Scarabæidæ—are moderately numerous; but until we know what proportion of them belong to the flower-haunting, and what to the dung-feeding group, we can draw no conclusion as to the presence of ruminant animals.

It is remarkable that few land- and fresh-water-shells have been found. There is a species of *Planorbis* with a thin shell and always damaged, a *Physa*, and a single specimen of a bivalve. Eight fishes have been found; also a sparrow-like bird (*Palæospiza bella*), with bones and feathers tolerably complete, a plover, and a finch. The plants are very numerous, and from 90 to 100 species have been determined by M. Lesqueroux.

From the character both of the animals and the plants, the climate, at the time of these deposits, is supposed to have been

similar to that of the shores of the Mediterranean. Nearly all the species which have been thoroughly studied are of a tropical —or at least subtropical—nature. Their position in time is considered to be in the later Eocene or early Miocene.

Dr. Shufeldt, in his memoir on the "Osteology of the Cathartidæ," which are now considered to form a family distinct from the vulturine Falconidæ of the Eastern Hemisphere, describes all the American genera and species. The question whether a second species of condor (*Sarcoramphus*) exists, or if the specimens so named are merely immature forms of the ordinary *S. gryphus*, is still undecided.

Bulletin of the Philosophical Society of Washington. Washington: 1883.

Among the papers which have been read before the Society is one on "Recent Investigations of the Lighthouse Board on the Anomalies of Sound from Fog Signals." The author exposes the common error that sound is always heard in all directions from its source according to its intensity or force, and according to the distance of the hearer from it. He proves, for instance, that a sound is sometimes inaudible when comparatively near at hand, and becomes distinct when the hearer removes to a greater distance. Again, whilst sound is generally heard further with the wind than against it, yet under certain circumstances the reverse is the case.

Mr. J. J. Woodward, the retiring President, read an exceedingly interesting address on "Modern Philosophical Conceptions of Life." As the subject of this paper will probably be considered at length in our pages at no distant date, we shall not here enter upon its discussion.

Mr. C. A. White and Mr. Antisell both conclude that on great plains Artesian wells have failed to be of any practical value for the irrigation of land.

Mr. Elliott Coues read a paper on the "Possibilities of Protoplasm," which has also been republished under the title "Biogen: a Speculation on the Origin and Nature of Life. Dr. Coues upholds the existence of a special vital principle which he contends is the cause, not the result, of the peculiar properties of protoplasm. He challenges men of Science to show what is the chemico-physical difference between living and dead protoplasm. He defines "soul" as that quantity of spirit which a living body may or does possess. "Spirit," again, he takes to be immaterial, self-conscious force, whilst life consists in the animation of matter by spirit. The substance of mind he terms *biogen* or

"soul-stuff," and defines it as spirit in combination with the minimum of matter necessary to its manifestation.

Hence it would seem, according to the speaker, that spirit may combine with matter in various proportions.

This paper led to a discussion in which some strange views were brought to light.

Mr. Doolittle maintained that in biology, just as in chemistry, in physics, and in astronomy, we must have what we still lack—a measure. He asks, "Is there more life in two mice than in one mouse? In a horse than in a mouse?" The term "automatic," as used by Mr. Coues, he considers "a confession of biological ignorance."

Mr. Powell pointed out that in the reasoning of Dr. Coues there was a fundamental and fatal error, "the axiom that the whole equals the sum of all its parts had been assumed to be true qualitatively as well as quantitatively." He himself "admitted neither force nor a vital principle, but merely matter in motion. Three relations were always to be borne in mind, *viz.*, quantity, quality, and succession, whereas the physicist falls into error by considering only the quantitative relation."

Mr. Gill thought there was a tendency on the part of biologists ignorant of philosophy, and philosophers ignorant of biology, to make a distinction between organic and inorganic matter, and to call in a vital force.

Mr. C. S. Busey read a memoir on "The Influence of the Use of High-heeled Shoes upon the Health and Form of the Female, and upon the Relations of the Pelvic Organs." The author contends that, in addition to the distortion of the foot, there is danger of increased obliquity of the pelvis, which may be an important factor in the causation of certain disorders of the female reproductive organs.

Mr. Gill proposes a modification in the arrangement of the insectivorous mammals. He unites the typical Insectivora and the Dermaptera in one order, but regards them as sub-orders. He distributes the true or typical Insectivora into two groups characterised chiefly by the molars.

The volume closes with an "Annual Address," by Mr. W. B. Taylor, who takes for his subject "Physics and Occult Qualities." We have here a destructive criticism of kinematic theories. The kinematist tells us that action at a distance is a metaphysical impossibility, whilst the dynamist assures us quite as positively that action at no distance is a demonstrated physical impossibility. Is there, then, no motion at all? We are reminded of Newton's dictum that action at a distance is a manifest absurdity; but we hear less frequently that, in his "Optics," the same philosopher subsequently asked "Have not the small particles of bodies certain powers, virtues, or forces, by which they act at a distance?" Not unjustly does the author remark, "There is no mystery in the world of mind that is not fully

paralleled by mysteries as bewildering in the world of matter."

The reflection, however, naturally suggests itself that the author, as well as Mr. J. J. Woodward and Mr. Elliott Coues, and, on the other hand, their opponents, may be regarded as travelling beyond the legitimate boundaries of Science, and raising issues with which the human intellect is unable to grapple.

The Utility and Morality of Vivisection. By G. GORE, LL.D., F.R.S. London: Kolckmann.

THIS valuable pamphlet is, as we learn from the title-page, "issued by the Association for the Advancement of Medicine by Research." It need scarcely be said that we are gratified at any manifestation of life and activity in a body of which so very little is to be heard.

The author begins by defining the term "Vivisection" as used in his title. It is to include "those experiments to which Bestiarians object, *viz.*, all kinds of painful ones on animals." One misfortune is that they consider, or at least call, *all* experiments upon animals "painful."

With an amount of patience and self-control which is truly admirable, Mr. Gore wades through the cavils, the quibbles, the illogicalities of the Bestiarians,—matter of such a nature that we can scarcely understand how it can be believed, much less uttered, by men and women in their sound senses,—and exposes its fallacious nature. He shows that hatred of Science altogether is to a large extent a ruling principle with these fanatics. He reminds his readers that at one time it was a violation of "public sentiment" to watch the motions of the heavenly bodies. He shows that if the results obtained by the physiologist are sometimes doubtful, such is the case also even in the simpler and easier sciences, in physics, in chemistry, and in astronomy itself. Yet such uncertainty is held to be a reason not for discontinuing experiments and observations, but for multiplying them under varied conditions. The uncertainty of results in physiology is merely somewhat greater in degree than in the other sciences.

The Bestiarians, it appears, complain of the existence of true physiologists who work simply for the love of truth, without any thought of the "good of mankind." This, Mr. Gore shows, is merely a case of the division of labour. One man discovers, another applies. Why should such a division be objected to?

The fanatics further assert that "we have splendid and rapidly

developing methods in hundreds of other directions," and that if vivisection were utterly stopped the result would be "the finding of far better and more certain means of discovery." Can the utterers of such froth name even one such means? If they can, why do they keep silence?

Agitations generally are not marked by truthfulness; but the Anti-vivisection movement, wherever it exists, has been above all others characterised by an excess of falsehood in every form. The prominent part which England has taken in this hubbub has certainly contributed to lessen the already slight respect in which she is now held abroad. For the country which is the very head-quarters of "sport"—in other words, of the infliction of pain for pure amusement—to object to comparatively few and generally slight inflictions of pain in pursuit of knowledge, seems to other nations the *ne plus ultra* of inconsistency and hypocrisy.

We can conscientiously recommend Mr. Gore's pamphlet, and we trust it may have a wide circulation. Greater activity is called for among men of Science. The tactics of the enemy have been to go on throwing dirt, in the hope that some of it at least will stick,—to pour out invectives, well knowing that a falsehood may be uttered in few words, whilst its exposure will often necessitate many.

Sunspottery; or, What do we Owe to the Sun? A Popular Account of the Spots on the Sun, their Phenomena, Nature, and Cause, with an Inquiry into their alleged Influence upon the Weather, Famines, Pestilences, Commercial Panics, &c. By J. A. Westwood Oliver. London: Simpkin, Marshall, and Co.

We do not know whether the author of this pamphlet is responsible for the inelegant, and in our humble opinion superfluous, word "sunspottery." His conclusion is given very unmistakably. He remarks that the sun's activity waxes and wanes periodically, that his radiation undergoes a corresponding variation, that our meteorological conditions which depend upon the solar heat fluctuate accordingly, and that these events more or less directly related to the accident of weather exhibit a like change, are each and all assumptions supported only by evidence of the weakest kind; and can we be expected to hang our faith upon a chain of reasoning every link of which is defective?" He adds, in conclusion, "We may say, then, that an impartial examination of the evidence available leads to but

one conclusion, which is that sunspottery is *not* what it is represented to be, but is, for the most part, humbug."

This inference Mr. Oliver draws from the admittedly conflicting character of the evidence brought forward. The grand difficulty is that periods of heat and cold are not felt simultaneously over the whole earth, but are confined within arbitrary limits. The mild winter we have had in Europe, accompanied by a correspondingly hot summer in the Southern Hemisphere, led many people to believe that the earth was passing through a wave of heat, whether connected with the number and magnitude of sun-spots or not. But lo! our mild winter was accompanied by an exceptionally cold one in North America. The other season Britain, France, Switzerland, Italy, and Western Europe in general, were shivering in a cold, wet summer, whilst Austria, Hungary, Russia, and Turkey basked in unclouded sunshine. The attempt, however, to trace periodicity in biological phenomena seems to us eminently praiseworthy. If such cycles are found, their connection with cosmic phenomena is a subsequent task.

ERRATUM.—In our June issue, p. 366, line 16 from bottom, *for* "could digest things" *read* "could not digest things."

CORRESPONDENCE.

*** The Editor does not hold himself responsible for statements of facts or opinions expressed in Correspondence, or in Articles bearing the signature of their respective authors.

TECHNICAL TRIALS.

"An Old Technologist" would reform Technical Trials; but while he sees a few flaws of the actual, he has keener sight for the possible flaws of the possible. He thinks that of all Law proceedings the least satisfactory are Technical Trials. I question not their badness, but their eminence of badness. Let him hear trials for libel or slander, and he may think them

"By merit raised to that bad eminence."

Let him next hear trials for conspiracy, wherein the conspiracy is itself the crime, and the right of eminence may be again transferred (*sic*); then let him hear the mock form of trial for "contempt of court,"—"if form it may be called which form has none,"—and again he may transfer the palm. Then let him ask all classes what is their *practical* trust in law and its administration, and he will get a unanimous opinion that is hard to reconcile with the established facts,—that Law is perfect reason, the wisdom of the Bench, and the honour of the Bar. I dare only say that I have failed to find them: don't destroy my remaining faith in the jury; even juries are mortal, and need reform. Whether it would be good reform to let "the Court" appoint experts as assessors to judges, I doubt. "Technologist" admits the Court's incapacity to decide questions of Science: would he let the same ignorant Court decide among scientific men? Heaven preserve the Homœopath defendant if the Court should choose an Allopath assessor! Woe betide the patentee under an assessor without faith in the Patent Laws! And if the assessor is to "expound to the jury the conclusions of Science," and to be exempt from examination and cross-examination, one might guess that these conclusions are either so proved that they may be taken from a text-book, or so disputable that they may be the very matters disputed.

"An Old Technologist" fears that technical language can be understood only by the technical; but a trial needs little technical language, and that little can be explained. Among botanists a botanist speaks of *Myosotis*, *Ranunculus*, and *Bellis*, but among common folk he speaks of forget-me-nots, buttercups, and daisies.

In your June number Mr. Fraser turns "incandescent-lamps" into "glow-lamps," and he may get rid of "arc-lamps" by calling them "spark-lamps."

For free Government trial by jury is almost as essential as a House of Commons. Juries have less prejudice and more sense than judges, but they need reforms :—

1. Abolish all exemptions.
2. Let the jury list be chosen by the parliamentary voters.
3. Let three jurors be named by agreement of parties, or, in default, by lot, and let four more be named by lot, seven making the jury.
4. Treat them with honour: let them be "the Court," and let judges be their assistants.
5. Abolish unanimity, and after an hour's discussion let the majority decide. Let the minority record their opinion, and let it be the only ground for fresh trial.
6. Make the jury judges of law as well as of fact.
7. Give the jury power to stop insulting and idle cross-examination by the Bar, and to fine silly jokes by the Bench.

NOMIKOS.

June 7, 1884.

[We inserted the communication of "An Old Technologist" in order to ventilate a grievance which scientific men feel very strongly. Into the general question of the defects of any other than technical trials, or into any "reforms" of the courts of justice, we have no right to enter.—ED. J. S.]

HYLOZOISM AND HYLO-IDEALISM.

FOR so interesting a writer as C. N. to fall into the error of asserting that "whatever philosophy the future has in store must be built on the seemingly (!) narrow foundation" of *the part containing the whole* is indeed a misfortune for the philosophy she (?) so ably advocates, since it may tend to a hesitancy on the part of some "mystical mathematicians and transcendental chemists" in accepting her leadership through these realms, with which, lying "beyond thought and perception," they "can have nothing to do."

The "Autocentric ideal," though "wide and lofty as thought, and clear and vivid as sensation," is based upon the assumption that "the world, as we know it," "is produced within that 'crumpled pocket-handkerchief' called the cerebrum." Now, as the cerebrum is part of the world, this is tantamount to saying that the whole (unknown) is produced by, or contained in,

a part (of the unknown), and this is gravely set forth as an explanation of the mystery of the Universe.

Such loose and shallow thinking forms but a poor platform whence to sneer at the sublimity of the Cosmos, or to raise doubts as to our having "very much to do with thoughts and perceptions which shine dimly through long spaces of years."

The fact is this: we must either admit matter (cerebrum, world, and all) to be real, in which case the infinity and sublimity of the Cosmos, however "nauseous" such themes may be to C. N., must also impress themselves upon students of that Cosmos as real, in proportion to the amount of their observation (and "nauseous," surely, in inverse proportion thereto); or, we must give up matter (cerebrum and all), and assert our own immaterial existence, as the centre, if you will, of an immaterial environment (to whom such assertion will doubtless be immaterial).

But to plead a material brain as the procreator of a phenomenal world, and to deny that world the materialism we arrogantly usurp for that brain, and on such a foundation to plant the philosophy of an "Autocentric ideal," is very effectively to invalidate the claims of such a philosophy to one moment's consideration or attention, either on the part of Spiritualists or Materialists.

F. P. L.

Brixton, June 3, 1884.

SELF-PURIFICATION OF RIVERS.

With reference to the article by "Argus," in your May number, I wish to call your attention to an additional instance of a polluted river becoming purer as it flows.

A Mr. G. Rydill, in the preamble to the specification of a patent (A. D., No. 391), states that he is well acqu'anted with the River Calder, which at a certain part is so foul that fish cannot live in it. But after flowing for about four miles, and passing over three wears, it becomes so much purified that fish make their appearance along with other forms of higher life, both animal and vegetable.

Inventor.

NOTES.

THE Royal Microscopical Society, after careful deliberation, have decided upon admitting ladies to all the privileges of fellowship, attendance at the ordinary meetings excepted. The large collection of microscopic objects, amounting to some thousands of slides, will during the winter months be examined and arranged by a committee of experts, and rendered available for consultation by the Fellows. Owing to the absence of a catalogue the treasures in the possession of the Society are almost unknown, but the cabinet contains many specimens—the work of Quekett, Bowerbank, and other pioneers—which, apart from their intrinsic merits, must always possess considerable historical value.

Dr. B. Placzek ("Popular Science Monthly") has collected citations from the Talmud to show that the old Jewish writers were keen observers of Nature, and had ideas akin to Darwinism. Joseph Albo, in the fifteenth century, suggested the thought of compensation, or interchange of relations, in a hypothesis that cattle are defective in teeth because so much of the tooth-stuff goes to horn. Other writers noticed that the integrity of the comb of the cock had much to do with its masculine potency, and that other birds suffer in spirit and vigour when deprived of their ornamental appendages. Passages are quoted that point to the thought that the difference in mental gifts between man and (other) animals is only quantitative.

(Those who assert that the Semitic mind is radically unscientific will do well to reconsider their position. Altogether the scientific attainments of antiquity were much greater than we commonly suppose. They would have been greater still had it not been for Socrates and his school.)

Dr. H. Macnaughton Jones, in a recent work, declares:—"After nearly twenty years of constant teaching in a large school of medicine, and some years of experience as a University Examiner, I have come to the conclusion that for future success in life the test of examinational proficiency is a most fallacious one": and again, "I can conceive no more certain plan for the physical ruin of thousands of the youths of a country than the system of capitation fees from results of examination."

In North America the cold during the past winter has been exceptionally severe. At Knoxville, lat. 36° N., the minimum was −26·7° C.; whilst at Malta, in the same latitude, it was +5°.

M. Andries ("Ciel et Terre") contends that hail is formed during ascending whirlwinds.

M. Hirn ("Comptes Rendus") concludes that we must count by millions of degrees in estimating the internal temperature of the sun.

M. Hugo Gyldén, in a communication to the French Academy of Sciences, maintains that the relative distances of the principal planets in their primordial state must have been much smaller than they are at present.

The Bestiarians have held an "International Congress" to protest against the crucial experiment by which M. Pasteur proposes to demonstrate the efficiency of his vaccine for rabies. Mrs. A. Kingsford, M.D., who made herself very prominent on this occasion, exclaimed that M. Pasteur was not justified in "torturing thousands of animals" with the object of abolishing so "very rare" a disease. The "thousands" when translated into the language of sober reason shrink to 40! As for the "rarity," we must remember that 21 persons died of hydrophobia in the Department of the Seine within twelve months!

A belief prevails in certain rural districts of France that the direction of the wind on Palm Sunday will predominate during the first half of the year. M. de Touchimlekt has studied the case, and finds that in a series of fifteen years the belief was justified seven times and failed eight. In general it holds good if the wind on the day in question blows from the south-west, but not if the current is north-easterly.

Mr. S. E. De Morgan ("Light") points out several errors in the utterances of Koot Hoomi as given by Mr. Sinnett (see "Journal of Science," 1882, pp. 405, &c.).

The occurrence of the Egyptian cobra (*Naja Haje*) has been demonstrated by M. Valery Mayet, who has captured a fine specimen not far from Oued Leben.

M. Mussett ("Comptes Rendus") shows that the supposed influence of light on the anatomic structure of the leaves of *Allium ursinum* is non-existent.

Dr. T. Tommasi ("Cosmos les Mondes") notes that the thermic constant of thallium is exactly the mean of the thermic constants of potassium and lead, the two metals which it most resembles in its chemical character.

M. Trouvelot, of the Observatory of Meudon, after observing the shadows thrown by the faculæ on the penumbræ of sun-spots, suggests that the brilliant light emitted by the faculæ, and perhaps the entire light of the sun, is generated at its surface, the presence of the coronal atmosphere being, perhaps, necessary for its production.

American and Continental papers are still discussing the bearings of the Huddersfield lead-poisoning case of 1882. It is deplorable that inventors do not seek to devise some safe substitute for lead as a material for water service-pipes—surely a nobler task than to devise new means for the destruction of life and property, and to play into the hands of the vilest of criminals!

The anæmia of brickmakers, well known in Italy, and recently observed at Bonn, is caused by the presence of an entozoon, *Anchylostomum duodenale*. The disease is contracted by drinking water from muddy pools.

M. G. Rolland ("Comptes Rendus") shows that since the beginning of the Tertiary epoch the Sahara has been dry land, save a relatively limited region at the north-east which was covered by the Eocene Sea. At the end of the Miocene all the north of Africa was above water, and since then, during the Pliocene and the Quaternary, the outline of the south shore of the Mediterranean has not sensibly varied.

It is to be feared that, as far as the lighting of towns is concerned, the electric light has been snuffed out in Britain by recent legislation. Its only immediate future must be in manufacturing establishments where the current can be produced and distributed without crossing any public road.

We are happy to find that the study of the physical sciences as compared with that of classics is on the increase in Scotland.

Mr. H. H. Smith ("American Naturalist") maintains that three distinct cats have been confounded under the name of jaguar (*Felis onça*). In the normal form the black spots are arranged in groups of five or six each on an ochre or tawny ground. In the *Onça pintada* or *cachorro* the spots are smaller, and scattered evenly without grouping, whilst in the *tigre* grouped spots occur on a brown-black ground. The hunters declare that all these varieties "breed true," and that crosses are rare.

According to the "Lundy Index" nitrogen protoxide is naturally evolved from the shales of the Tioga Hill, in California.

Mr. J. B. Armstrong, of the Botanic Garden, Christchurch, New Zealand, believes that red clover in that island is becoming modified in its structure, so as to admit of fecundation by means of insects which do not visit it in England.

M. Aug. Charpentier ("Comptes Rendus" after a series of experiments on the perception of colours, arrives at the following laws:—The perception of differences of illumination is the more easy the less the refrangibility of the colours. For one and the same chromatic intensity the perception of differences in illumination is the same for all saturated colours, and for an equal visual intensity the perception of the differences of illumination is the same in all colours.

According to the "American Naturalist" the "moths from the Great Basin have a peculiarly bleached and faded appearance, probably resulting from the light soil and bright skies of Utah and the adjoining territories."

A Professor Dulles, speaking possibly in the interests of dogs and dog-worshippers, denies the very existence of hydrophobia!

An anti-vivisection meeting of ladies and clergymen has been held at Edinburgh. The usual absurdities were repeated.

It is not generally known that Pascal opposed the Copernican theory, not as scientifically erroneous, but as tending to heresy.

MM. Grehant and Quinquaud ("Comptes Rendus") have demonstrated that the blood of the hepatic and splenic veins, and of the vena porta, contain always more urea than the arterial blood, or the venous blood of the limbs and the head.

M. Chevreul contends that the three colours of Young—red, green, and violet—cannot be accepted as primitive until it is demonstrated why yellow should be excluded.

Prof. Haeckel has presented the collections which he made during his recent tour in Ceylon, &c., to the University of Jena, where they are now arranged in the "Zoological Institute."

D. Amate proves experimentally that the chemical action of light is restricted within certain limits and temperature.

The "Medical Press and Circular" asks whether Mr. Jesse has become converted to reason, and withdrawn from the Bestiarian camp? If so, we may have hopes even for Miss F. P. Cobbe and Ouida.

The establishment of a biological station at St. Andrews is strongly urged, and is to be decidedly recommended.

Dr. G. Wyld ("Light") tells us that just as Slade was persecuted by the Agnostics, so Eglinton is threatened and persecuted by the Theosophists.

Prof. E. D. Cope ("American Naturalist") divides men into three classes with reference to the practical use they make of their intellect. These types are the mercantile, the literary, and the scientific.

According to the "Calcutta Englishman" Dr. V. Richards has succeeded in producing the cholera artificially in swine.

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